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7. Abstract

This document was prepared by Dr. Joesph Wachter of Los Alamos National Laboratory's NMT-4 group. It details the test methodology and requirements as specified by WHC for Acceptance/Qualification testing of a Boxed Waste Assay System designed and constructed by Pajarito Scientific Corporation.

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8. RELEASE STAMP

TEST PROCEDURE FOR BOXED WASTE

ASSAY SYSTEM

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1.0 TEST ITEM IDENTIFICATION

Testing of the Boxed Waste Assay System (BWAS) at the Plutonium Facility (TA 55) at Los Alamos National Laboratory will be performed to ascertain system adherence to procurement specification requirements (detailed in WHC-S-033). The test program shall include demonstration of the conveyor handling capabilities, gamma-ray energy (GEA) analysis, and imaging passive/active neutron (IPAN) accuracy and sensitivity. Integral to these functions is the system's embedded operating and data reduction software. The following features shall be evaluated during the test program.

1.1 CONVEYOR SYSTEM

The ability of the conveyor system to handle various types and sizes of waste boxes will be verified.

1.2 MATERIAL HANDLING SYSTEM

With respect to the BWAS, the material handling system is a forklift. The ability of a forklift to safely and efficiently load and remove the different waste box types from the positioning platform of the system shall be subjectively evaluated during the tests.

1.3 SYSTEM AVAILABILITY

System availability is defined here as:

$$SA = \frac{MTBF}{MTBF + MTTR} \quad (1)$$

MTBF is the Mean Time Between Failures

MTTR is the Mean Time to Repair

MTTR shall not exceed 2 hours

A record of BWAS operating history shall be maintained during the test program. From this record, system availability will be determined, and the system's compliance with procurement specifications will be evaluated.

1.4 OFF-STANDARD CONDITIONS

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A number of off-standard scenarios will be generated and the ability of the BWAS operating system to satisfactorily respond to them will be examined. The scenarios will include:

- Box size larger than 8' L x 5' W x 5' H.
- Waste box initially placed out of position.
- Loss of electric power.
- Electric power fluctuations.
- Unsecured box waste (traveling source).

1.5 COMPLIANCE WITH ALLOWABLE RADIATION FIELD LIMITS DURING ACTIVE NEUTRON AND GAMMA-RAY ATTENUATION MEASUREMENTS

To assure compliance with LANL requirements listed in *The Laboratory Manual*, Chapter 1, Environment, Safety, and Health, Section 3, radiation fields from the neutron generator and mixed $^{60}\text{Co}/^{137}\text{Cs}$ sources used for determining gamma-ray attenuation factors shall be tested via direct measurements within the proximity of the BWAS while these system elements are activated. In addition, the functionality of the safety interlocks provided to prevent accidental exposure of personnel shall be evaluated.

1.6 GAMMA-RAY ENERGY ANALYSIS

The GEA system's sodium iodide (NaI) and high purity germanium detection (HPGe) capabilities shall be inspected. Testing shall be performed:

- To generate energy vs efficiency curves for the NaI and HPGe detectors.
- To verify the system's ability to identify and determine the quantity present of at least nine individual radionuclides which emit gamma rays within the range of 40 KeV to 1.6 MeV. The nine radionuclides of interest are ^{60}Co , ^{134}Cs , ^{137}Cs , ^{125}Sb , ^{144}Ce , ^{154}Eu , ^{155}Eu , ^{235}U , and ^{239}Pu .
- To evaluate GEA system resolution to determine that procurement specification requirements are met. The HPGe resolution requirement shall be tested at the

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1.3 MeV line of ^{60}Co .

- To verify the GEA lower detection limit (LDL) for the system is 20 pCi/g, or less, for ^{60}Co and ^{137}Cs .

1.7 PASSIVE-ACTIVE NEUTRON MEASUREMENT

The ability of the passive-active neutron portion of the system to accurately assay waste boxes within the prescribed limits set forth in the procurement specification shall be tested. In addition, additional testing to further characterize assay system performance (i.e. determine assay system accuracy as a function of waste matrix composition and actinide loading) shall be performed.

1.8 IMAGING CAPABILITIES

Imaging capabilities of the BWAS's neutron and gamma-ray assay subsystems shall be evaluated. Using appropriate radionuclides, multiple discrete sources shall be placed at prescribed locations within the waste boxes and the system's ability to establish source position within 21" verified.

1.9 CONTROL AND COUNTING ALGORITHMS

The software and algorithms which provide for BWAS control and data acquisition/reduction are "embedded" within the assay system. As such, system calibration will be evaluated during the test program.

1.10 DETERMINATION OF LOW-LEVEL WASTE BOX CLASSIFICATION

The ability of the system to determine whether box contents meet low level waste criteria as defined by WHC-EP-0063-4 for fission and activation products (FAP) and for plutonium will be tested. These tests will be performed for three matrix compositions and four different box types.

1.11 SYSTEM SHIELDING

The system shall be tested to determine whether the equivalent of:

- 2 Kg of plutonium passing within 10 feet of the neutron and gamma-ray

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subsystems of the BWAS

or

● a container registering 200 mR/h at the surface passing within 10 feet of the neutron and gamma-ray subsystems of the BWAS

will affect assay accuracy or result in the premature cessation of the assay. In addition, the system will be tested to determine whether the presence of 24 g of ²³⁷Np near the gamma-ray subsystem of the BWAS will affect assay accuracy or result in premature cessation of the assay.

1.12 AUTO CYCLE FUNCTION

The functionality of the auto cycle option to make repeated measurements of the same box shall be tested. The auto cycle option shall be employed to make repeated measurements of test boxes as required by this procedure. Testing shall verify that data obtained for each of the assays is retained, and that the data sets are automatically assigned distinguishing numbers.

1.13 BWAS/FACILITY COMMUNICATIONS INTERFACE

The ability of the BWAS to communicate via an ANSI/IEEE Std. 802.3 Local Area Network (LAN) shall be demonstrated by having the BWAS local control and remote computers communicate by way of an Ethernet LAN connection. A software protocol (NOVELL or Windows NT) shall be provided to facilitate communication between the BWAS control and simulated network computers. Both the local and remote computers, as well as the software, are to be supplied by Pajarito Scientific Corp. The successful transmission of data, waste characterization information, and control commands across this communication link during the course of system testing shall be considered verification of the BWAS's LAN compatibility.

2.0 GENERAL DESCRIPTION

Guidelines for this test procedure were determined from the Test Specification for Qualification/Acceptance Testing of a Boxed Waste Assay System by Los Alamos National Laboratory (WHC-SD-W026-TS-001, Rev 1). The procedure is to be used to document and control planned test activities in accordance with the testing, data

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acquisition, and Quality Assurance requirements established in that document. Testing of all components listed in this procedure is to be performed at the Plutonium Facility at Los Alamos National Laboratory (LANL) after installation and calibration of the system there by Pajarito Scientific Corporation. The test program shall be considered complete when all tests specific to the components discussed in Paragraph 11 of this procedure have been concluded.

2.1 TEST OBJECTIVES

The two primary objectives of the BWAS test program are:

- Verify that the performance of the BWAS meets or exceeds the requirements of the Procurement Specification (WHC-S-033). The Specification identifies those BWAS functions which require verification via testing.
- Determine that BWAS performance levels are within the bounds of the waste matrices and radionuclide contents that the system is anticipated to encounter during its service life at the Waste Receiving and Processing (WRAP) facility.

2.2 TEST METHOD

Tests of the BWAS material handling system, conveyor system, communication systems interface, performance under off-standard conditions, auto cycle function, and BWAS/Facility communications interface are to be performed in a qualitative fashion. That is, cognizant personnel will evaluate the performance of these system components and evaluate their safety, effectiveness, and convenience based on their experience with similar components in use elsewhere. System availability, compliance with allowable radiation field limits, gamma-ray energy analysis, passive/active neutron analysis, imaging capabilities, control/counting algorithms, determination of waste box classification, and system shielding will be evaluated in a quantitative fashion according to the details laid out in this Test Procedure. Hold points are established within this procedure to verify that instruments and reference materials used to test the BWAS meet the requirements detailed in the Test Specification. These hold points, to be completed by LANL and WHC QA personnel, are required prior to continuation of the test effort. In addition, off standard condition tests will be verified by LANL QA personnel. Should an anomaly occur at any of these hold points or at any other point in the test program, a Test Anomaly Report (Data Sheet 1) will be initiated and the anomaly will be reported in the log book (WHC-N-972) dedicated to BWAS testing at

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LANL. A method of recovery and/or resolution will be proposed in the Report. Proposed disposition shall be approved by WHC, LANL, or Pajarito Scientific Corporation (PSC) prior to continuation of the testing. WHC and PSC concurrence may be obtained either directly from the cognizant WHC or PSC representative residing at LANL or via FAX transmission.

Field changes to test procedure specifications which do not result in degradation of test program quality are permitted under this procedure. These changes can be made only with approval of WHC. They will be indicated in this procedure in red ink and shall be dated and initialed by the cognizant WHC and LANL representatives. In addition, an entry shall be made into the dedicated BWAS test log book which specifies the change required, reason for the change, and the signatures and dates of the cognizant LANL and WHC personnel. Alternatively, WHC concurrence may be completed via FAX transmission. The information identified above would be transmitted to WHC with provision for signature. The signed transmission would then be sent back to LANL and signed by the cognizant LANL representative. All field changes shall be incorporated into the test log book under the appropriate day's entries. To facilitate prompt disposition of hold point validations, anomaly resolutions, and field changes, all WHC and PSC approvals shall be performed within LANL notification time limits specified in this Test Procedure.

3.0 TEST CONDITION LIMITS

Prior to beginning the tests, all hardware, firmware, and software components of the System must be assembled, calibrated, and fully operational at the Los Alamos Plutonium Facility by PSC personnel. During the test program, operating temperatures for the BWAS may vary between 55 ° F and 88 ° F. Relative humidity may range from 30% to 50%. Ventilating and air conditioning (HVAC) for the Plutonium Facility maintains the building within these temperature and humidity parameters. During the course of the testing, the environment shall be monitored to ensure that temperature and humidity are within these parameters. The results will be recorded in the BWAS log book. Should temperature or humidity fall outside these bounds, testing shall be discontinued until normal operating conditions can be re-established.

4.0 INSTRUMENTS AND CALIBRATION

Prior to initiation of testing, all component and system calibrations shall be completed. A hold point which requires the signatures of cognizant WHC, PSC, and

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LANL personnel has been established which indicates that BWAS calibration has been completed and testing can begin. The calibration of the system and any of its components may not be altered during the performance of all testing required by this procedure. Should the BWAS require recalibration during the course of testing, all testing performed subsequent to the last accurate pink box measurement shall be void and shall be performed again using the new calibration settings.

To verify the BWAS's stability during the conduct of testing, a pink box measurement shall be made at every change of either box or matrix type. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised or significantly changed since the last pink box measurement, it shall be considered an anomaly, and the provisions of Section 10.5 of this procedure shall be implemented. In particular, all box assays performed since the last successful pink box measurement shall be reviewed and a method of resolution for suspect data proposed.

5.0 FACILITIES, EQUIPMENT, AND MATERIALS

Testing at LANL will require the following equipment and materials:

- The sources defined in Tables 5-1a, 5.1b and 5-1c, or WHC-approved equivalents, are required to conduct the testing in this procedure. A combination of distributed sources and lump quantities will be used to better quantify system response under a variety of measurement conditions. Values in parentheses in the tables indicate nominal source quantities.
- Four test boxes shall be required to complete the testing procedure. These test boxes are a Standard Waste Box (SWB), a B-25 Waste Box, a large aluminum waste box, and a small box. Volumes for these boxes are 63.5 ft³, 90 ft³, 190 ft³, and 27 ft³, respectively. The boxes will have dimensions and source tube centerline locations as specified in Figures 11-1 through 11-4 in this Test Procedure. The test boxes with source tubes are to be provided by PSC at the time of delivery of the BWAS System to the Los Alamos Plutonium Facility. In addition, PSC is to provide either the necessary materials (preferably cardboard) required to modify the large box, or empty boxes, of the dimensions shown in Table 5-2 to be used in off-standard conditions tests.

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TABLE 5-1a
REQUIRED ^{60}Co AND ^{137}Cs SOURCES

ISOTOPE	TARGET VALUE (μCi)	SOURCE ID	ISOTOPE	TARGET VALUE (μCi)	SOURCE ID
^{60}Co	5 (4.7)	CO4.7	^{137}Cs	5 (4.4)	CS4.4
	10 (10.2)	CO10.2		10 (9.5)	CS9.5
	25 (24.9)	CO24.9		25 (24.1)	CS24.1
	50 (46.4)	CO46.4		50 (54.1)	CS54.1
	100 (104.7)	CO104.7		100 (103.7)	CS103.7
	250 (271)	CO271		250 (292)	CS292
	500 (547)	CO547		500 (559)	CS559
	1000 (971)	CO971		1000 (1194)	CS1194

- Waste matrix simulants which represent three common WHC waste streams will be required for the tests. The waste streams to be represented are laboratory waste, medium density waste, and heavy density waste. For laboratory waste, defined as low density materials such as paper, rags, rubber gloves, and some glass; but without chlorinated plastics or other neutron absorbers, 200 ft³ of matrix simulant is required. For medium density waste, defined as low density (6-12 lb/ft³) waste consisting of such things as wood, construction materials, and other relatively light weight materials but without chlorinated plastics or other neutron absorbers, 200 ft³ of matrix simulant material will be required. For heavy density waste, defined as high density (up to 100 lb/ft³) waste such as concrete, soil, steel, lead, depleted uranium, and failed equipment, 200 ft³ of matrix simulant will be required for the test program.
- A calibrated scale with a maximum capacity of 12,000 lbs to determine weights of test waste boxes and simulants is required for the tests..
- A forklift with a minimum capacity of 5000 lbs will be required. It shall be employed for loading of boxes onto the BWAS.

TABLE 5-1b
REQUIRED DEPLETED URANIUM AND SMALL PLUTONIUM SOURCES

ISOTOPE	²³⁹ Pu EQUIVALENT VALUES (mg)	SOURCE ID	ISOTOPE	²³⁹ Pu EQUIVALENT VALUES (mg)	SOURCE ID
Plutonium or Depleted Uranium Sources	0.6	PSC0.6	Plutonium or Depleted Uranium Sources	1.0	LLWSTD5
	1.1	PSC1.1		2.3	PSC2.3
	2.6	LLWSTD4		3.4	PSC3.4
	5.5	LLWSTD3		9.0	LLWSTD2
	9.8	PSC9.8		14.0	PSC14.0
	19.9	PSC19.0		22.0	LLWSTD1
	29.6	PSC29.6		504.4	PSC504.4
				497.7	PSC497.7
				495.4	PSC495.4
				489.0	PSC489.0
				489.9	PSC489.9
				486.9	PSC486.9
				480.9	PSC480.9
				479.0	PSC479.0
				191.1	PSC191.1
				30.1	PSC30.1

- A manually controlled variable isolation transformer to be used in electric power fluctuation measurements.

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TABLE 5-1c
REQUIRED MIXED AND LARGE Pu SOURCES

ISOTOPE	TARGET VALUE (Grams Pu)	SOURCE ID
²³⁹ Pu	5 (5)	STD1 or STD2
	10 (10)	SGC10
	20 (21)	STDR3
	30 (30)	SGC30
	50 (60)	STD3
	100 (100)	SGC100
	250 (250)	SGC250
	500 (478)	STD9
	1000	TBD
	2000	TBD
SRM4275 Mixed Source	¹⁵⁴ Eu (1.32 µCi) ¹⁵⁵ Eu (0.27 µCi) ¹²⁵ Sb (0.36 µCi)	465-8-3

Note: All depleted uranium sources are to be provided to LANL by PSC. Plutonium sources other than those identified in the table may be used in the BWAS tests provided that their traceability and proximity to target values can be demonstrated.

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TABLE 5-2
OVERSIZE WASTE BOX DIMENSIONS

BOX NUMBER	LENGTH (Ft)	WIDTH (Ft)	HEIGHT (Ft)
1	10	5	5
2	8	5.5	5
3	8	5	5.5

6.0 SAFETY

Although there are no unique or unusual industrial, radiological, chemical, fire, or release-of-energy hazards associated with performing qualification/acceptance and characterization testing of the BWAS, several precautionary safety and regulatory analyses have been performed in conjunction with introducing the system into the Los Alamos Plutonium Facility. An Environmental, Safety, and Health Questionnaire was completed to identify potential environmental, safety, and health issues attendant to the test program. The issues that were identified as being of potential concern and their present status are listed below. A copy of the Questionnaire and the memorandum identifying potential ES & H issues are included in this document as Attachment A.

- A Department of Energy Environmental Checklist (DEC) identifying potential environmental concerns associated with BWAS testing was initiated at Los Alamos National Laboratory. The DEC was then reviewed by the Department of Energy (DOE) Albuquerque Office to assure compliance with the National Environmental Policy Act (NEPA). Upon completion of the review, the DOE Field Office in Albuquerque issued a categorical exclusion from the requirement to prepare further NEPA documentation for this project. Copies of the DEC and the categorical exclusion are included in Attachment B.
- A review of the test program was performed to determine compliance with the Resource Conservation and Recovery Act (RCRA) and the potential for generation of hazardous or mixed waste. The review concluded that no further RCRA evaluation was required and that no generation of hazardous or mixed waste was foreseen for the program. A copy of the Memorandum of Closure for this review is included as Attachment C.

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- The test program was reviewed to determine whether a radioactive air emissions preconstruction application was required under 40 CFR 61 prior to test initiation. The review concluded that the program does not require the preconstruction application. A copy of the Memorandum of Closure for this review is included in Attachment D.
- An Occupational Radiological Safety Assessment was performed by Los Alamos Health Physics (HSE-12) personnel in conjunction with the test program. The assessment determined that no radioactive contamination problems were associated with the project. A copy of the Memorandum of Closure for this assessment is included as Attachment E.
- A Radioactive Air Emissions Management review was performed for the program. The review concluded that no action is required to meet Los Alamos Air Emissions Management requirements. The Memorandum of Closure for this review is included here as Attachment F.
- A review of the test program for its potential to generate solid radioactive waste was also performed. Other than the test boxes and matrix simulants, little radioactive waste generation was expected from the program. A memorandum terminating this review is included as Attachment G.
- The program was reviewed for its compliance with Los Alamos waste minimization efforts. All waste minimization issues were resolved and a Memorandum of Closure (Attachment H) was issued.
- A Criticality Safety Review of the test program was performed to consider nuclear criticality issues associated with the test measurements. The conclusions from the review and criticality concerns attendant to the program are included in Attachment I.
- Finally, the test program was reviewed for operational safety. All concerns were satisfied during the review. A Memorandum of Closure for this aspect of the review process is included as Attachment J.

In addition, a further safety review specific to implementation of the test program at TA 55 will be performed after the BWAS is installed and operational at this facility. This review will be a Level 4 Safety and Technical Assessment for Readiness of

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Technology (START) assessment which integrates the test program with other operations here. For this review, the program will be scrutinized by the TA 55 Safety Officer, Radiation Protection personnel, Occupational Safety personnel, a Nuclear Criticality expert, fire protection personnel, and the operational group's safety committee. When the START review has been successfully completed, all relevant documentation will be forwarded to WHC.

7.0 MAINTENANCE AND FAILURES

Although the BWAS is to be maintained by PSC during the course of the testing program, LANL is to monitor system availability as described in Equation (1). In addition, anomalies and system failures which disrupt data acquisition during testing will be documented in the test log book and, in conjunction with WHC and PSC, a method of recovery and/or resolution proposed. Provision is made in this test procedure to permit field changes that do not result in degradation of test program quality. Should the tests indicate that the BWAS has failed to meet one, or more, of the procurement specifications, WHC will be contacted. However, failure of the BWAS to meet procurement specifications will not hinder continuation or completion of the test program.

8.0 TEST DATA

Test log book WHC-N-972 1 shall be maintained during the conduct of BWAS testing. Entries shall be made by LANL personnel during the time that testing is underway. WHC and PSC personnel may also make log entries. At a minimum, log entries shall include:

- Interruption of test activities due to equipment malfunction. For these entries, the type of malfunction, time to repair, and required action shall be reported.
- Temperature.
- Relative humidity.
- Personnel conducting the tests.
- Potential sources of error in the measurements.

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- Anomalies which affect the conduct of the testing or findings with regard to BWAS performance not provided for within the test procedure.

At the completion of the testing at LANL, the log book shall be transmitted to WHC with the test report.

In addition, the following data shall be obtained during the course of the Los Alamos test program and recorded as indicated in Section 11 of this procedure.

8.1 NaI SPECTRAL DATA

Spectral data acquired by the NaI detectors for each box type, source location, and waste matrix simulant shall be recorded.

8.2 NaI DETECTOR VS EFFICIENCY CURVES

Detector energy vs efficiency curves and associated spectral data for the NaI detectors as a function of source location, waste matrix, and box type shall be reported.

8.3 HPGe LOCATION AND ENERGY VS EFFICIENCY CURVES

HPGe detector location and HPGe energy vs efficiency curves with associated spectral data shall be recorded for source placement 25 cm along the detector centerline.

8.4 ⁶⁰Co AND ¹³⁷Cs SOURCE DATA

⁶⁰Co and ¹³⁷Cs source data used during the tests for the gamma-ray portion of the BWAS shall be reported. This includes recording of source location, counting period, spectral data, average height of Compton region, region of interest descriptions, count rates in the regions of interest, peak widths (and their method of determination), background levels, and calculation of peak ratios.

8.5 POST ANALYSIS PRINTOUTS

BWAS post analysis printouts which identify the results of the spectral analysis and their comparisons to known values shall be reported.

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8.6 GAMMA-RAY AND NEUTRON MEASUREMENT DATA

For neutron and gamma-ray analysis of empty and loaded waste crates; box type, matrix simulant, source loading (isotope, activity, and location), assay duration, assay values, matrix attenuation factors, waste categories, assay values, temperature, and humidity will be reported.

8.7 MEASUREMENT ANOMALIES

Test log book entries which indicate difficulties which have occurred during the measurements or loading of the waste boxes onto the BWAS turntable and identification of box type, dimensions, relative fork positions, and method of resolution shall be reported.

8.8 SYSTEM DOWN TIME AND AVAILABILITY

BWAS operating times, temperature, humidity, system downtime, associated downtime cause, and time to repair will be entered into the test log book. System availability, defined by Equation (1) shall also be recorded.

8.9 POWER SUPPLY DISRUPTION

For power supply disruption and power fluctuation tests; box and waste matrix type, source loading and location, disruption time, voltage fluctuation (RMS) vs time curve, reported assay values, and source locations shall be reported.

8.10 UNSECURED BOX WASTE

For unsecured box waste (traveling source) tests; box and waste matrix types, source loading and location, source travel range, gamma attenuation factors, and assay values will be reported.

8.11 HIGH RADIATION FIELDS

Results of measurements of radiations fields surrounding the BWAS while the Radiation Generating Device is operational will be reported in the test log book.. Also, verification that the safety beacons function during gamma source deployment and neutron interrogation of waste boxes and verification of the functionality of the safety

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shutdown switch inside the assay chamber will be recorded.

8.12 HIGH BACKGROUND MEASUREMENTS

Source location, activity, waste box type, loading, and assay value will be reported during tests to determine whether placement of 2 kg of plutonium (or a source registering 200 mR/h at the surface) or 24 g of ^{237}Np within 10 ft of the BWAS affects system accuracy.

8.13 OVERSIZE WASTE BOX MEASUREMENTS

Empty boxes or a modified large box, with dimensions as shown in Table 5-2, shall be placed on the BWAS turntable and an assay initiated. Results for each oversize box type shall be recorded according to Section 11.12 of this procedure.

8.14 ASSIGNATION OF WASTE CATEGORY

Results of the BWAS analysis to determine the waste category for each box and matrix type will be reported.

8.15 GAMMA-RAY AND NEUTRON IMAGING DATA

Raw data and measurement information pertinent to the neutron and gamma-ray imaging analyses will be reported.

9.0 PERSONNEL REQUIREMENTS

Personnel who participate in the BWAS test program will have met all security, safety, and training requirements necessary for access to the Los Alamos Plutonium Facility. Security requirements include:

- Active Q clearance.
- Membership in the Los Alamos Personnel Security Assurance Program (PSAP).

Safety requirements include:

- All BWAS test personnel will acquire safety shoes (steel toe), safety glasses,

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and will wear required anti-contamination clothing while engaged in work at the Plutonium Facility.

Training requirements include:

- General Employee Training (GET).
- Radworker I and Radworker II Training.
- General Hazards Communication Training.
- Waste Generation Overview Training.
- Plutonium Facility Site Specific Training.

10.0 WITNESSES

Dated signatures of cognizant LANL, WHC, or PSC personnel shall be made at the completion of the data acquisition activities as described below.

10.1 FIELD CHANGES TO TEST PROCEDURE

After field changes to the test procedure which do not result in degradation of test program quality, the date of the change and initials of cognizant WHC and LANL personnel shall be entered into the affected section of the test procedure and into the test log book. For these changes, WHC concurrence may be completed via FAX transmission.

10.2 QUALITY ASSURANCE WITNESS

Provision for LANL Quality Assurance (QA) sign-off in the test procedure prior to initiation of certain test steps is provided for the following activities. Sign-offs shall be entered on this Test Procedure in the spaces indicated.

10.2.1 Calibration of Scales

Calibration accuracy of the scales used to determine the weight of the boxes shall be ascertained and signed-off at initiation and completion of BWAS testing

at LANL.

10.2.2   Gamma-Ray Source Records

Records pertinent to the gamma-ray sources used in testing the NaI and HPGe detectors shall be examined to verify their traceability to certified standards and signed-off by a QA representative.

10.2.3   Uranium Source Records

Records of analyses performed to determine the relative abundances of ^{235}U and ^{238}U in the uranium sources provided by Pajarito Scientific Corporation shall be examined, their suitability for the analysis methodology confirmed, their reported composition verified, and signed-off by a QA representative.

10.2.4   Plutonium Source Records

Records pertinent to the plutonium isotopes used in BWAS testing shall be examined, verification of their traceability to recognized standards confirmed, and signed-off.

10.2.5   Radiation Field Calibration Records

The calibration date and calibration expiration date for the instruments used to measure radiation dose fields during operation of the BWAS's neutron generator and deployment of the gamma-ray source trains used to measure gamma-ray transmission shall be verified and signed off at the time measurements are made.

10.3   HOLD POINTS

Hold Points are established at several points within the procedure at the completion of steps so that the suitability of equipment and reference materials used to test the BWAS can be ascertained. At these points, provision is made for LANL concurrence and approval of the test equipment's performance. Should any piece of equipment fail a test at a hold point, a Test Anomaly Report (Data Sheet 1) must be generated and a description of the anomaly must be recorded in the log book.

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10.4 OFF STANDARD CONDITION TESTS

After completion of each of the off-standard conditions tests, cognizant LANL and WHC witnesses will attest to the test's completion by signing the Off Standard Condition Test Verification block in Section 11 of this Test Procedure.

10.5 SYSTEM ANOMALIES

Anomalies that occur which disrupt data acquisition activities during testing or which indicate a failure to meet procurement specifications will be documented and a method of recovery and/or resolution proposed. Proposed disposition shall be approved by WHC, PSC, and LANL. A sample Test Anomaly Report is included as Data Sheet 1. WHC (and PSC) approval of anomalies may be obtained either directly from the cognizant WHC representative residing at LANL or via FAX transmission.

11.0 PROCEDURE

The system will be delivered to the Los Alamos Plutonium Facility and set up in the basement of the Facility by LANL craftsmen under the direction of PSC. Within two months after set up, PSC personnel will have completed all set-up activities related to calibration, installation of matrix correction factors, and software development so that the system can be operated independently by LANL and WHC personnel. In addition, PSC will have provided all boxes, matrix simulants, and uranium sources to be used in the tests.

The step-by-step procedure for performing the tests, witnessing steps, QA verification, and recording of test data is described below. In the test procedure, the ordering of the test box measurements is immaterial for the purposes of the test program and may be altered according to availability of materials or the convenience of test personnel. However, a measurement of the pink box will take place prior to beginning a series of measurements on each test box and matrix type and at the end of the program. The raw results of all measurements will be kept by LANL and/or WHC personnel during the course of the measurements and will be shared with PSC representatives in a timely manner. On completion of the tests, all data will be turned over to WHC.

11.1 TEST PRECONDITIONS

11.1.1 Safety Inspection

Prior to delivery of the BWAS from PSC to LANL, the system will be inspected for safety concerns by LANL personnel to determine its suitability for use at the LANL Plutonium Facility. All required corrections to the system will be made prior to introduction of the system into the Los Alamos Plutonium Facility. Results and recommendations from the safety inspection will be entered into the ES & H Inspection Report (Data Sheet 2).

Also, the ¹³⁷Cs and ⁶⁰Co sources used during the test program shall be verified against the requirements listed in Section 2.10 of the Test Specification. Descriptions of all tests and their results and any maintenance or deficiencies in the shielding and safety systems shall be reported in the BWAS log book along with any anomalies. Radiation surveys will be performed by Radiological Control personnel when the sources are first installed after entering TA 55 and, at a minimum, every 6 months thereafter. Verification shall consist of the following.

11.1.1.1 Measurements of Radiation Fields Direct measurements of the radiation fields in the proximity of the BWAS while the neutron generator is operational shall be performed in compliance with Chapter 1 of *The Laboratory Manual, Environmental, Safety, and Health*.

11.1.1.2 Safety Interlocks System interlocks which prevent accidental exposure of personnel during operation of the system shall be tested. All interlock failures will be reported on an ES & H Inspection Report (Data Sheet 2).

11.1.1.3 System Shut-Down Switch Operation of the system shut-down switches both within and outside the assay chamber will be tested. All failures will be reported on a ES & H Inspection Report (Data Sheet 2).

11.1.1.4 Safety Beacons Operation of the safety beacons during gamma-ray and neutron measurements will be tested. All failures will be reported on a ES & H Inspection Report (Data Sheet 2).

The following hold point is established upon successful completion of the Safety Inspection. WHC concurrence may be performed via FAX transmission. In order to

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limit Test Procedure delays, WHC concurrence shall be made within four hours of notification of completion of the Safety Inspection by LANL.

HOLD POINT:

_____
LANL Representative

_____
Date

_____
WHC Representative

_____
Date

11.1.2 Calibration and Box Source Tube Dimensions

A hold point is established prior to initiation of testing to assure that all BWAS component and system calibrations have been completed. To verify that all calibration requirements have been met, the following hold point is established upon successful completion of the BWAS calibration. WHC and PSC concurrence may be performed via FAX transmission and should be made in a timely manner.

Hold Point:

_____
Signature of WHC Representative

_____
Date

_____
Signature of PSC Representative

_____
Date

_____
Signature of LANL Representative

_____
Date

In addition, the calibration of the platform scales used to weigh the boxes and matrix simulants must be verified by a LANL QA representative at the hold point established below:

Hold Point:

_____
Signature of LANL QA Representative

_____
Date

Calibration dates and calibration expiration dates for the instruments used to measure radiation dose fields during operation of the neutron generator and deployment of the gamma-ray source trains shall also be verified in the hold point established below by a LANL QA representative:

Hold Point:

_____
Signature of LANL QA Representative

_____
Date

Verification that the source tube diameters and locations for the test boxes comply with those specified in Figures 11-1 through 11-4 in this Test Procedure will be indicated in the hold point below:

Hold Point:

Signature of LANL QA Representative

Date

Figure 11-1
SWB Source Tube Configuration

11.1.3 Verification of Test Sources

Documentation on the activities, isotopic composition, and gram loadings of the ^{137}Cs , ^{60}Co , SRM 4275, uranium, and plutonium sources shall be examined, verification of their traceability to recognized standards confirmed, and signed-off in the space provided below prior to initiation of the test program.

Hold Point:

Signature of LANL QA Representative

Date

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Figure 11-2
B-25 Source Tube Configuration

11.2 SYSTEM AVAILABILITY

System availability, defined by Equation (1), will be evaluated during the test program by recording the following information into the log book during days on which BWAS measurements are performed.

- Time BWAS energized
- Temperature and Humidity
- BWAS operations and assays performed
- System down time, and cause
- Time required for any repairs
- Time of system shutdown
- BWAS Operator names.

System availability is defined as

$$SA = \frac{MTBF}{MTBF + MTTR}$$

MTBF is the Mean Time Between Failures

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MTTR is the Mean Time To Repair
MTTR shall not exceed two (2) hours.

11.3 AUTO CYCLE FUNCTION

During the course of the Test Program, the ability of the BWAS to perform repeated measurements using the Auto Cycle function shall be tested. Testing shall verify that data obtained for each of the assays is retained and that the data sets are automatically assigned distinguishing numbers. If the BWAS is unable to meet these requirements, an entry in the log book will be made indicating the system's response to an Auto Cycle command.

11.4 BWAS/FACILITY COMMUNICATIONS INTERFACE

The ability of the BWAS to communicate via an ANSI/IEEE Std. 802.3 Local Area Network shall be demonstrated during the course of the Test Procedure by having the BWAS local control and remote computers communicate by way of an Ethernet LAN connection. A software protocol such as NOVELL or Windows NT shall be used to facilitate communication between the BWAS control and a simulated network computer. The software, local and remote computers, and peripheral hardware are to be supplied by PSC. The successful transmission of data, waste characterization information, and control commands across this communication link during the course of system testing shall be considered verification of the BWAS's LAN compatibility. The results of this test shall be recorded in the log book.

11.5 MEASUREMENT OF MIXED SOURCE

The mixed source SRM 4275 will be measured in the empty chamber. For this measurement, the source shall be placed and rotated through the position matrix shown in Figure 11-5. The raw data results from the gamma-ray instruments will be attached to a completed Measurement Data Sheet (Data Sheet 3) for each position in the matrix. Measurements of this source for the empty chamber and for the different box types, matrix types, and source locations will partially serve as the basis of the energy vs efficiency curves for the NaI and HPGe detectors and will aid in characterizing system response.

Next, the mixed source will be placed 25 cm from the HPGe detector along the detector's centerline. Using a 200 sec counting time, spectral data shall be obtained to

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establish an energy vs efficiency curve.

11.6 EMPTY CHAMBER GAMMA-RAY MEASUREMENTS

Also in the empty chamber, NaI and HPGe detector measurements shall be performed with the ^{137}Cs and ^{60}Co sources to determine the peak-to-Compton ratio, full-width at half-maximum (FWHM), full-width at one-tenth maximum (FWTM), and full-width at one fiftieth maximum (FW.02M). The peak-to-Compton ratio for the ^{137}Cs source will be determined using the 661.6 keV gamma-ray and the relatively flat interval from 358 keV to 382 keV. The same gamma-ray peak will be used to determine the FWHM, FWTM, and FW.02M test results. For ^{60}Co , the gamma-ray peak used to determine peak-to-Compton and resolution tests shall be at 1332.5 keV whereas the flat interval from 1040 to 1096 keV will be used to complete the peak-to-Compton evaluation. Results of these tests will be reported on the BWAS Gamma-Ray System Report (Data Sheet 4).

11.7 SYNTH TESTS

The ability of the BWAS to identify isotopic composition shall be tested by supplying the system with synthetic HPGe spectral data using the SYNTH software to be developed and supplied by WHC. SYNTH will be used to generate simulated HPGe spectra. At present, SYNTH is the only method available for demonstrating the ability of the BWAS to identify isotopes of interest. Test cases for SYNTH shall be prepared in accordance with Table 2-1 of the Test Specification and tested under the operating conditions at the Los Alamos Plutonium Facility. The BWAS-generated reports for each test case shall be evaluated against input values.

11.8 STANDARD WASTE BOX MEASUREMENTS

11.8.1 Pink Box Measurement

The pink box, used to check the calibration and stability of the system, will be loaded with the appropriate sources and measured with both the gamma-ray and neutron portions of the BWAS at every change of either box or matrix type. However, an assay of the pink box is not required on a daily basis, nor for each change in test box source loading. Results of the measurements, along with temperature, humidity, operating personnel, date of measurement, will be entered into the Measurement Data Sheet (MDS) shown in Data Sheet 3. Raw data print outs from the BWAS will be

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attached to the MDS. Temperature and humidity conditions and any measurement

Figure 11-3
Small Box Source Tube Configuration

Figure 11-4
Large Box Source Tube Configuration

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Figure 11-5
BWAS Assay Chamber Position Matrix

anomalies also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.8.2 Measurement of SWB Without Sources or Matrix

The empty Standard Waste Box (SWB) will be weighed with calibrated platform scales, then set on the BWAS measurement platform via forklift. The ease of loading the box onto the platform will be subjectively evaluated and any anomalies will be recorded into the test log book. Five (5) repeated measurements of the empty box then will be performed with the gamma-ray and neutron measurement systems of the BWAS. Results of the empty box measurement will be recorded on an Measurement Data Sheet (Data Sheet 3) and the raw measurement results, including individual detector response, will be attached to the Measurement Data Sheet. The box location with respect to the centerline of the NaI detectors will also be recorded on the MDS.

Note: The maximum incremental change in box position during all data acquisition

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shall be one foot.

11.8.3 Measurement of SWB With Laboratory Matrix But Without Sources

Next, the SWB will be loaded with as close to 400 lbs of laboratory matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of SWBs loaded with simulated lab waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the SWB loaded with laboratory matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.8.4 Measurement of SWB With Laboratory Matrix Simulant and Sources

Upon completion of the measurements of the SWB containing laboratory matrix simulant only, the accuracy and imaging properties of the system will be assessed with the radionuclide loadings indicated in Table 11-1. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-1 shall be consecutively assayed five times using the auto cycle function. All results will be reported on an MDS (Data Sheet 3) and attached to the raw data print outs.

The imaging capability of the gamma-ray and neutron aspects of the BWAS will also be evaluated during the course of the measurements indicated in the paragraph

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above. This will be done by determining the location of each of the sources prior to BWAS analysis and comparing these values to the reported source locations and isotopic compositions reported in the measurement. The coordinate system used to establish source locations is shown in Figure 11-6 of this procedure.

Note: Depleted uranium may be substituted for plutonium loadings of less than 5 grams in this and all subsequent tables in this test procedure. ^{137}Cs and ^{60}Co loadings for this and all subsequent measurements will be generated using combinations of the sources listed in Table 5-1a.

11.8.5 Measurement of SRM 4275 in SWB with Laboratory Matrix Simulant

For this same box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Results will be entered on an MDS (Data Sheet 3) and attached to the BWAS data printout.

11.8.6 Power Interruption During SWB Measurement

The SWB containing actinide and fission and activation sources in a simulated low density matrix that is indicated by the asterisk in Table 11-1 shall have the 120VAC power supply interrupted for approximately 1 sec while the box is in the

Nal gamma-ray assay chamber and during the acquisition of spectra. In addition, similar disruptions in the power supply shall be tested during the neutron assay and HPGe data acquisition periods. This may be accomplished by toggling the breaker for the electrical feed to the BWAS. The BWAS response shall be logged in the log book. If the assay is not halted during the power interruption, assay accuracy shall be verified. Results of the test shall also be reported on an Off-Standard Conditions Report (OSCR) form shown in Data Sheet 5. Information on the box and waste matrix type, source loading and location, disruption time, voltage interruption vs time data, and reported assay value should be reported on the OSCR. This information will be appended to the raw data results. In addition, completion of this off standard condition

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Table 11-1
Target Radionuclide Loadings for the SWB Loaded with Laboratory
Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
10	10	3 mg	CS9.5, CO10.2, PSC0.6, PSC2.3
25	1250	15 mg	CS24.1, CO271, CO971, PSC1.1, PSC14.0
35	900	44 mg	CS9.5, CS24.1, CO104.7, CO271, CO547, PSC14.0, PSC29.6
175	600	145 mg*	CS103.7, CS24.1, CS54.1, CO46.4, CO547, PSC2.3, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, LLWSTD1, LLWSTD2, LLWSTD3
350	350	435 mg	CS54.1, CS292, CO104.7, CO271, PSC479.0
600	175	1 g	CS54.1, CS559, CO104.7, CO24.9, CO46.4, PSC493.0, PSC504.4
900	35	10 g	CS292, CS559, CS54.1, CO10.2, CO24.9, SGC10
1250	25	50 g	CS1194, CS54.1, CO24.9, STD3

* For the source loading indicated by the asterisk, the measurement shall be performed five times consecutively (see Section 11.8.4 of this Test Procedure). In addition, power fluctuation tests, traveling source measurements, incorrect box loading tests, and measurements in high radiation background will also be performed with this source loading (see Sections 11.8.6 through 11.8.10 of this Test Procedure).

test will be witnessed by cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

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Off Standard Condition Test Verification:

Signature of LANL Witness

Date

Signature of WHC Witness

Date

11.8.7 Power Fluctuations During SWB Measurement

During the testing of the same source loading indicated in Section 11.6.6 of this Test Procedure, an assay will be initiated to determine the system's response to power fluctuations. During the course of the assay, the 120 V_{RMS} AC power supply shall undergo step changes per the voltage vs time curve shown in Figure 11-7(A). A manually controlled power transformer will be used to provide the power fluctuations. The variation in system voltage shall occur during the following segments of the assay process:

- Nal gamma-ray transmission measurement.
- Nal box waste data acquisition.
- Active neutron assay.
- Passive neutron assay.
- Acquisition of spectral data by the HPGe detector.

A similar assay of the same box then will be performed a second time with the timing of the voltage fluctuations as shown in Figure 11-7(B) for each of the measurement steps indicated above. Results of these test shall be reported both in the test log book and on an OSCR (Data Sheet 5) form and attached to the raw data results. The OSCR should include information on the box and waste matrix type, source loading and location, disruption time, voltage fluctuation (RMS) data, and reported assay values. Completion of this off standard condition test will be witnessed by a cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

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Off Standard Condition Test Verification:

Signature of LANL Witness

Date

Signature of WHC Witness

Date

Figure 11-6
BWAS Assay Chamber Coordinate System

11.8.8 Traveling Source Measurement

An assay of a box containing a "traveling" source will be performed to determine the accuracy of BWAS assays when box contents shift during the measurement process. Here, the assay to be performed with the source loading indicated by an asterisk in Table 11-1, will be interrupted midway through the measurement and the actinide and FAP sources shall be moved not less than 2' and not more than 4' along the box's length. The reported assay value will be entered on an OSCR form (Data Sheet 5), attached to the raw data results, and compared to the known box loading. The OSCR should include information on the box and waste matrix type, source loading and location, source travel range, gamma-ray attenuation factors, and assay value. In addition, completion of this off standard condition test will be witnessed by cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results,

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Off Standard Condition Test Verification:

Signature of LANL Witness

Date

Signature of WHC Witness

Date

11.8.9 Incorrect Box Loading Test

The response of the BWAS for waste boxes located out of position on the turntable will be tested by placing the SWB indicated by an asterisk in Table 11-1 on the turntable such that it overhangs the front of the pallet by six inches, then initiating an assay. Similarly, the same SWB next will be placed such that it overhangs the end of the pallet by six inches, and an assay will be initiated. The response of the BWAS for the two tests will be recorded on an OSCR (Data Sheet 5) and in the log book. In addition, completion of these two tests for the SWB will be witnessed by cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

Off Standard Condition Test Verification:

Signature of LANL Witness

Date

Signature of WHC Witness

Date

11.8.10 Measurement of SWB in High Radiation Background

During measurements of the source loading indicated by an asterisk in Table 11-1, two tests shall be performed to demonstrate whether system accuracy or operation is affected by the presence of large background sources. These tests shall be performed by placing 1) the equivalent of 2 kg of plutonium (or a container registering 200 mR/hr at the surface), and 2) 24 g of ²³⁷Np within 10 ft of the BWAS during an assay. The background measurement for the plutonium (or 200 mR/h equivalent container) test will be performed by placing the item 10 feet from the midpoint of the neutron detector subsystem, measuring the dose equivalent (in REM) of the field at 10 feet from the source, and then carrying out an entire BWAS assay. Next,

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Figure 11-7
Voltage vs Time Curves for Power
Fluctuation Tests

the plutonium item will be placed 10 feet from, and on a line at the midpoint between the NaI detector plane and the HPGe detector, the exposure (in Roentgens) will be measured 10 feet from the source, and a second complete assay will be performed. The ^{237}Np background measurement will be conducted by placing the item 10 feet from, and on a line at the midpoint between the NaI detector plane and the HPGe detector, the exposure (in Roentgens) will be measured 10 feet from the source, and a complete assay will be performed. The reported assay will be entered onto an OSCR form (Data Sheet 5), attached to the raw data results, and compared to the known box loading. The OSCR should include information on source location, activity, waste box type, loading, and assay value. On completion of all high radiation background measurements of the SWB, sign-offs by cognizant LANL and WHC representatives will be performed prior to continuation of the test program. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

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High Background Test Verification:

Signature of LANL Witness

Date

Signature of WHC Witness

Date

11.8.11 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the SWB containing medium density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered into an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.8.12 Measurement of SWB With Medium Density Matrix Simulant But Without Sources

Next, the SWB will be loaded with as close to 800 lbs of medium density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant LANL representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of SWBs loaded with medium density matrix simulant shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit delays to the Test Procedure, WHC concurrence shall be made within four hours of the box weight measurements or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the SWB loaded with medium density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will

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be attached.

11.8.13 Measurement of SWB with Medium Density Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-2. Results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement data. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-2 shall be consecutively assayed five (5) times using the auto cycle function.

11.8.14 Measurement of SRM 4275 in SWB with Medium Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be measured in two locations

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. The results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.8.15 Pink Box Measurement

One complete measurement of the complete box will be performed prior to initiating measurements of the SWB containing heavy density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement, will be entered into an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

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Table 11-2
Target Radionuclide Loadings for the SWB Loaded with Medium
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
1940	5	6 mg	CS103.7, CS559, CS1194, CS9.5, CS24.1, CS54.1, CO4.7, PSC2.3, PSC3.4
10	5	30 mg	CS9.5, CO4.7, PSC30.1
150	150	88 mg	CS103.7, CS54.1, CO104.7, CO46.4, PSC1.1, PSC2.3, PSC3.4, PSC19.9, PSC29.6, PSC30.1
500	500	290 mg	CS559, CO547, PSC2.3, PSC3.4, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1
750	750	870 mg	CS292, CS559, CO271, CO547, PSC2.3, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, PSC504.4, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
1250	1250	1 g	CS54.1, CS1194, CO271, CO971, PSC493.0, PSC504.4
1750	1750	15 g	CS559, CS1194, CO271, CO547, CO971, SGC10, STD1
5	10	30 g	CS4.4, CO10.2, SGC30
5	1940	100 g*	CS4.4, CO104.7, CO271, CO547, CO971, CO46.4, SGC100

11.8.16 Measurement of SWB with Heavy Density Matrix Simulant But Without Sources

The SWB will be loaded with as close to 3200 lbs of heavy density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with heavy matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of SWBs loaded with simulated lab waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results,

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whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the SWB loaded with heavy density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.8.17 Measurement of SWB with Heavy Density Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-3. For the loading indicated by a single asterisk in the table, erroneous characterization data (incorrect source loading) will be supplied to the BWAS computer prior to initiation of the assay. This will test the ability of the system to compensate for incorrect operator entries. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no geometrical symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with a double asterisk (**) in Table 11-3 shall be consecutively assayed five (5) times using the auto cycle function. Results will be reported on an MDS (Data Sheet 3) and attached to the raw data results.

11.8.18 Measurement of SRM 4275 in SWB with Heavy Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- ① into the source tube at a point 6" into the box
- ① at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Results shall be reported on an MDS (Data Sheet 3) and attached to the raw data results.

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Table 11-3
Target Radionuclide Loadings for the SWB Loaded with Heavy
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
30	50	348 mg	CS4.4, CS24.1, CO46.4, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
1940	50	1.16 g	CS103.7, CS559, CS1194, CS4.4, CS24.1, CS54.1, CO46.4, PSC191.1, PSC479.0, PSC480.9
1250	350	3.48 g	CS54.1, CS1194, CO104.7, CO271, PSC29.6, PSC479.0, PSC480.9, PSC493.0, PSC495.4, PSC497.7, PSC502.7, PSC504.4
1750	1750	50 g	CS559, CS1194, CO271, CO547, CO971, STD3
350	1250	100 g	CS54.1, CS292, CO271, CO971, SGC100
50	1940	200 g*	CS54.1, CO104.7, CO271, CO547, CO971, CO46.4, STDR3, SGC30, STD3, SGC100
50	30	400 g**	CS54.1, CO4.7, CO24.9, STD3, SGC100, SGC250

11.9 B-25 BOX MEASUREMENTS

11.9.1 Pink Box Measurement

On completion of all measurements on the SWB and prior to beginning a series of measurements on another box type, the pink box will be loaded with appropriate sources and measured with both the gamma-ray and neutron portions of the BWAS. Results of these measurements, along with all additional information on test conditions will be entered into a Measurement Data Sheet (Data Sheet 3) and attached to the raw data results. Temperature and humidity conditions and any measurement or system anomalies will also be recorded in the log book for all measurements of this box type.

11.9.2   B-25 Box Measurement Without Sources or Matrix

The empty B-25 box will be weighed with calibrated platform scales, then set upon the BWAS measurement platform and measured with the gamma-ray and neutron measurement portions of the BWAS. The source trains for establishing gamma-ray transmission values will be deployed into their operational position within the assay chamber during this measurement. Results of the empty B-25 measurement, including box location with respect to the centerline of the NaI detectors, will be recorded on an MDS (Data Sheet 3) and attached to the raw measurement data.

11.9.3   Measurement of B-25 With Laboratory Matrix Simulant But Without Sources

The B-25 box will be loaded with as close to 560 lbs of laboratory matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of B-25s loaded with simulated lab waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight   Signature of LANL Representative   Date

WHC Witness to Proceed   Date

Five (5) repeated BWAS measurements will be performed on the B-25 loaded with laboratory matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.9.4   Measurement of B-25 with Laboratory Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-4. For each of the loadings in the table, two different arrangements of the sources will be assayed. In all cases, the source

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loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-4 shall be consecutively assayed five (5) times using the auto cycle function. All results will be reported on an MDS (Data Sheet 3) and attached the raw data results.

11.9.5 Measurement of SRM 4275 in B-25 with Laboratory Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Results of this test will be reported on an MDS (Data Sheet 3) and attached to the raw data results.

**Table 11-4
Target Radionuclide Loadings for the B-25 Box Loaded with
Laboratory Matrix Simulant**

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
150	150	4 mg	CS103.7, CS54.1, CO104.7, CO46.4, PSC0.6, PSC1.1, PSC2.3
5	1250	21 mg	CS4.4, CO271, CO971, PSC, 1.1, PSC19.9
15	750	41 mg	CS4.4, CS9.5, CO271, CO547, PSC1.1, PSC9.8, PSC30.1
75	350	62 mg	CS24.1, CS54.1, CO104.7, CO271, PSC2.3, PSC29.6, PSC30.1
350	75	206 mg	CS54.1, CS292, CO24.9, CO46.4, PSC14.0, PSC191.1
750	15	62 mg*	CS292, CS559, CO4.7, CO10.2, PSC2.3, PSC29.6, PSC30.1
1250	5	206 mg	CS54.1, CS1194, CO4.7, PSC14.0, PSC191.1

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11.9.6 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the B-25 containing medium density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered into an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.9.7 Measurement of B-25 With Medium Density Matrix Simulant But Without Sources

The B-25 box will be loaded with as close to 1100 lbs of medium density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of B-25s loaded with medium density waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the B-25 loaded with medium density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.9.8 Measurement of B-25 with Medium Density Matrix Simulant and Sources

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The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-5. For each of the loadings in the table, two different arrangements of the sources will be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-5 shall be consecutively assayed five (5) times using the auto cycle function. All results will be reported on an MDS (Data Sheet 3) and attached to the raw data results.

11.9.9 Measurement of SRM 4275 in B-25 with Medium Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. The results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.9.10 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the B-25 containing heavy density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered onto an MDS (Data Sheet 3) and attached to the raw data printout. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.9.11 Measurement of B-25 With Heavy Density Matrix Simulant But Without Sources

The B-25 box will be loaded with as close to 4500 lbs of heavy density matrix simulant (but no sources) that can be reasonably achieved. The signature of a

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Table 11-5
Target Radionuclide Loadings for the B-25 Box Loaded with Medium
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
750	15	8 mg	CS292, CS559, CO4.7, CO10.2, PSC0.6, PSC1.1, PSC2.3, PSC3.4
10	1940	82 mg	CS9.5, CO104.7, CO271, CO547, CO971, CO46.4, PSC2.3, PSC19.9, PSC29.6, PSC30.1
15	1750	123 mg	CS4.4, CS9.5, CO271, CO547, CO971, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, LLWSTD1
5	750	411 mg	CS4.4, CO271, CO547, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
1750	10	411 mg	CS559, CS1194, CO10.2, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
1940	5	41 mg*	CS103.7, CS559, CS1194, CS54.1, CS24.1, CO4.7, PSC1.1, PSC9.8, PSC30.1

cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of B-25s loaded with heavy density waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the B-25 loaded with

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heavy density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.9.12 Measurement of B-25 with Heavy Density Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-6. All results will be reported on an MDS (Data Sheet 3) and attached to the raw data results. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. For the box marked with a single asterisk in Table 11-6, erroneous characterization data (incorrect source loading) will be entered into the BWAS computer. To test the stability of the system, a single arrangement of the source loading marked with two asterisks (**) in Table 11-6 shall be consecutively assayed five (5) times using the auto cycle function.

11.9.13 Measurement of SRM 4275 in B-25 with Heavy Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.10 SMALL BOX MEASUREMENTS

11.10.1 Pink Box Measurement

On completion of all measurements on the B-25 box and prior to beginning a series of measurements on another box type, the pink box will be loaded with appropriate sources and measured with both the gamma-ray and neutron portions of the BWAS. Results of these measurements, along with all relevant test conditions

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Table 11-6
Target Radionuclide Loadings for the B-25 Box Loaded with Heavy
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
150	1940	0 mg	CS103.7, CS54.1, CO46.4, CO104.7, CO271, CO547, CO971
400	1750	0 mg*	CS103.7, CS292, CO271, CO547, ACO971
600	750	329 mg	CS54.1, CS559, CO271, CO547, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2
750	400	493 mg	CS54.1, CS103.7, CS559, CO104.7, CO271, CO24.9, PSC493.0
1250	300	1644 mg	CS54.1, CS1194, CO271, CO24.9, PSC191.1, PSC480.9, PSC493.0, PSC504.4
1940	100	4933 mg**	CS103.7, CS559, CS1194, CS4.4, 46CS9.5, CS24.1, CS54.1, CO104.7, PSC479.0, PSC480.9, PSC486.9, PSC489.0, PSC489.9, PSC493.0, PSC495.4, PSC497.7, PSC502.7, PSC504.4

will be entered onto a Measurement Data Sheet. The raw measurement data also will be attached to the MDS (Data Sheet 3). Temperature and humidity conditions and any measurement or system anomalies will also be recorded in the log book for all measurements of this box type.

11.10.2 Measurement of Small Box Without Sources or Matrix

The empty small box (SB) will be weighed with calibrated platform scales, then set upon the BWAS measurement platform and measured with the gamma-ray and neutron portions of the BWAS. Then, the source trains used for establishing gamma-ray transmission values will be deployed into their operational position within the assay chamber and gamma-ray and neutron detector response measured. Results of the empty SB measurement will be recorded on an MDS (Data Sheet 3) and attached to the raw measurement data. The box location with respect to the centerline of the NaI detectors will also be recorded on the MDS.

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11.10.3 Measurement of Small Box With Laboratory Matrix Simulant But Without Sources

The Small Box will be loaded with as close to 169 lbs of laboratory matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Small Boxes loaded with simulated laboratory waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Small Box loaded with laboratory matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.10.4 Measurement of Small Box with Laboratory Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-7. All results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement results. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-7 shall be consecutively assayed five (5) times using the auto cycle function.

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Table 11-7
Target Radionuclide Loadings for the Small Box Loaded with
Laboratory Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	SourceIDs
5	5	6 mg	CS4.4, CO4.7, PSC2.3, PSC3.4
10	10	18 mg	CS9.5, CO10.2, PSC0.6, PSC1.1, PSC2.3, PSC14.0
15	15	123 mg*	CS4.4, CS9.5, CO4.7, CO10.2, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, LLWSTD1

11.10.5 Measurement of SRM 4275 in Small Box with Laboratory Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.10.6 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the Small Box with medium density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered onto an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

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11.10.7 Measurement of Small Box With Medium Density Matrix Simulant But Without Sources

The Small Box will be loaded with as close to 337 lbs of medium density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Small Boxes loaded with medium density waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Small Box loaded with medium density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.10.8 Measurement of Small Box with Medium Density Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings indicated in Table 11-8. All results will be reported on an MDS (Data Sheet 3) and attached to the raw data results. For each of the loadings in the table; two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-8 shall be consecutively assayed five (5) times using the auto cycle function.

11.10.9 Measurement of SRM 4275 in Small Box with Medium Density Matrix Simulant

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For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

Table 11-8
Target Radionuclide Loadings for the Small Box Loaded with
Medium Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
5	1940	12 mg	CS4.4, CO104.7, CO271, CO547, CO971, CO4.7 CO10.2, CO24.9, CO46.4, PSC2.3, PSC9.8
10	10	37 mg	CS9.5, CO10.2, PSC1.1, PSC2.3, PSC3.4, PSC30.1
1940	5	247 mg*	CS103.7, CS559, CS1194, CS54.1, CS24.1, CS4.4, CO4.7, PSC2.3, PSC3.4, PSC19.9, PSC30.1, PSC191.1

11.10.10 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the Small Box containing heavy density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered onto an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.10.11 Measurement of Small Box With Heavy Density Matrix Simulant But Without Sources

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The Small Box will be loaded with as close to 1350 lbs of heavy density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Small Boxes loaded with heavy density waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Small Box loaded with heavy density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.10.12 Measurement of Small Box With Heavy Density Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings listed in Table 11-9. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-9 shall be consecutively assayed five (5) times using the auto cycle function. All results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement results.

11.10.13 Measurement of SRM 4275 in Small Box with Heavy Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box

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Table 11-9
Target Radionuclide Loadings for the Small Box Loaded with Heavy
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
5	15	148 mg	CS4.4, CO4.7, CO10.2, PSC2.3, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4
10	10	493 mg	CS9.5, CO10.2, PSC493.0
15	5	1148 mg*	CS4.4, CS9.5, CO4.7, PSC191.1, PSC479.0, PSC480.9

- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.11 LARGE BOX MEASUREMENTS

11.11.1 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the Large Box containing laboratory matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement will be entered onto an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.11.2 Measurement of Large Box Without Sources or Matrix

The empty Large Box (LB) will be weighed with calibrated platform scales,

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then set upon the BWAS measurement platform and measured with the gamma-ray and neutron measurement portions of the BWAS. During this measurement, the source trains for establishing gamma-ray transmission values will be deployed into their operational position within the assay chamber. Results of the empty Large Box measurements will be recorded on an MDS (Data Sheet 3) and attached to the raw measurement data. The box location with respect to the centerline of the NaI detectors will also be recorded on the MDS.

11.11.3 Measurement of Large Box With Laboratory Matrix Simulant But Without Sources

The Large Box will be loaded with as close to 1200 lbs of laboratory matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Large Boxes loaded with simulated laboratory waste matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Large Box loaded with LB matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.11.4 Measurement of Large Box with Laboratory Matrix Simulant and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings listed in Table 11-10. All results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement results. For each of the loadings in the table, two different arrangements of the sources shall be assayed. In all cases,

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Table 11-10
Target Radionuclide Loadings for the Large Box Loaded with
Laboratory Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²⁴¹ Pu Equiv	Source IDs
100	100	9 mg	CS103.7, CO104.7, PSC9.8
50	1940	43 mg	CS54.1, CO104.7, CO271, CO547, CO971, CO46.4, PSC3.4, PSC9.8, PSC30.1
350	1600	130 mg	CS54.1, CS292, CO104.7, CO547, CO971, PSC3.4, PSC9.9, PSC14.0, PSC19.9, PSC29.6, PSC30.1, LLWSTD1
500	1250	434 mg	CS559, CO271, CO971, PSC479.0
850	850	1.3 g*	CS292, CS559, CO24.9, CO271, CO547 PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, 191.1, PSC502.7, PSC504.4
1250	500	10 g	CS54.1, CS1194, CO547, SGC10
1600	350	100 g	CS103.7, CS292, CS1194, CO104.7, CO271, SGC100
1940	50	400 g**	CS103.7, CS559, CS1194, CS4.4, CS9.5 CS24.1, CS54.1, CO46.4, STD3, SGC100, SGC250

the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, and location. The loading marked with a single asterisk in the table shall have erroneous characterization data (incorrect source loading) supplied to the BWAS computer prior to assay initiation. To test the stability of the system, a single arrangement of the source loading marked with two asterisks (**) in Table 11-10 shall be assayed consecutively five (5) times using the auto cycle function.

11.11.5 Measurement of SRM 4275 in Large Box with Laboratory Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box

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- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.11.6 Pink Box Measurement

One complete measurement of the pink box will be performed prior to initiating measurements of the LB containing medium density matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement, will be entered onto an MDS (Data Sheet 3) and attached to the raw measurement data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed from the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.11.7 Measurement of Large Box With Medium Density Matrix Simulant But Without Sources

The Large Box will be loaded with as close to 2400 lbs of medium density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Large Boxes loaded with simulated medium density matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Held Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Large Box loaded

with medium density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.11.8 Measurement of Large Box with Medium Density Matrix and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings listed in Table 11-11. All results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement results. For each of the loadings in the table, two different arrangements of the sources will be assayed. In all cases, the source loadings shall be nonuniform and show no symmetry with respect to type, quantity, or location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-11 shall be consecutively assayed five (5) times using the auto cycle function.

11.11.9 Incorrect Box Loading Test

The response of the BWAS for waste boxes located out of position on the turntable will again be tested by placing the Large Box indicated with the asterisk in Table 11-11 on the turntable such that it overhangs the front of the pallet by six inches, then initiating an assay. Similarly, the Large Box will be placed such that it overhangs the end of the pallet by six inches. The response of the BWAS for the two tests will be recorded on an OSCR (Data Sheet 5) and in the log book. In addition, completion of these two tests for the Large Box will be witnessed by cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

Off Standard Condition Test Verification:

_____
Signature of LANL Witness
Date

_____
Signature of WHC Witness
Date

11.11.10 Measurement of SRM 4275 in Large Box with Medium Density Matrix Simulant

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For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

Table 11-11
Target Radionuclide Loadings for the Large Box Loaded with
Medium Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
10	25	17 mg	CS9.5, CO24.9, PSC0.6, PSC2.3, PSC14.0
50	15	87 mg	CS54.1, CO4.7, CO10.2, PSC1.1, PSC2.3, PSC3.4, PSC19.9, PSC29.6, PSC30.1
100	100	260 mg	CS103.7, CO104.7, PSC9.8, PSC29.6, PSC30.1, PSC191.1
350	500	868 mg	CS54.1, CS292, CO547, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, PSC504.4, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
750	500	2.6 g	CS292, CS559, CO547, PSC191.1, PSC479.0, PSC480.9, PSC493.0, PSC502.7, PSC504.4
1000	1000	10 g	CS1194, CO971, SGC10
1500	1500	100 g*	CS292, CS1194, CO547, CO971, SGC100
1940	1940	400 g	CS103.7, CS559, CS1194, CS9.5, CS24.1, CS54.1, CO104.7, CO271, CO547, CO971, CO46.4, SGC250, SGC100, STD3
15	10	800 g	CS4.4, CS9.5, CO10.2, STD9, SGC250, SGC100, STD3

11.11.11 Pink Box Measurement

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One complete measurement of the pink box will be performed prior to initiating measurements of the LB containing heavy matrix simulant. Results of the measurement, along with temperature, humidity, operating personnel, and date of measurement, will be entered onto an MDS (Data Sheet 3) and attached to the raw data print out. Temperature and humidity conditions, and any measurement anomalies, also will be recorded in the log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed since the last pink box measurement, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.11.12 Measurement of Large Box With Heavy Density Matrix Simulant But Without Sources

The Large Box will be loaded with as close to 9500 lbs of heavy density matrix simulant (but no sources) that can be reasonably achieved. The signature of a cognizant Los Alamos representative is required to attest to the final box weight after loading with waste matrix simulant. In addition, WHC concurrence and permission to proceed with measurements of Large Boxes loaded with simulated heavy density matrix shall be obtained. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the box weight measurement or within four hours of notification of the measurement results, whichever comes last.

Hold Point:

Box Weight

Signature of LANL Representative

Date

WHC Witness to Proceed

Date

Five (5) repeated BWAS measurements will be performed on the Large Box loaded with heavy density matrix simulant. The results will be recorded onto Measurement Data Sheets (Data Sheet 3) and the raw results, including individual detector response, will be attached.

11.11.13 Measurement of Large Box with Heavy Density Matrix and Sources

The accuracy and imaging properties of the system will be assessed for the radionuclide loadings listed in Table 11-12. All results will be reported on an MDS (Data Sheet 3) and attached to the raw measurement data. For each of the loadings in

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the table, two different arrangements of the sources shall be assayed. In all cases, the source loadings shall show no symmetry with respect to type, quantity, and location. To test the stability of the system, a single arrangement of the source loading marked with an asterisk in Table 11-12 shall be assayed consecutively five (5) times using the auto cycle function.

11.11.14 Measurement of SRM 4275 in Large Box with Heavy Density Matrix Simulant

For this box and matrix type, SRM 4275 shall be placed

- into the source tube at a point 6" into the box
- at the midpoint of the box's length

and detector response shall be measured in order to obtain detector energy vs efficiency curves. Measurement results will be recorded on an MDS (Data Sheet 3) and attached to the raw data results.

11.11.15 Pink Box Measurement

On completion of all measurements on the Large Box (or whichever box is measured last), the pink box will be measured with both the gamma-ray and neutron portions of the BWAS. Results of these measurements, along with all pertinent test conditions (temperature, humidity, operating personnel, and date of measurement) will be entered onto an MDS (Data Sheet 3). The raw measurement data will also be attached to the MDS. In addition, temperature and humidity conditions and any indication of system anomalies will be recorded in the system log book. Should reported radionuclide inventories for the pink box indicate that system calibration has been compromised, or significantly changed since the last pink box assay, it shall be considered an anomaly and the provisions of Section 10.5 of this Test Procedure shall apply.

11.12 MEASUREMENTS OF NON STANDARD BOXES

Empty boxes to be supplied by PSC with dimensions shown in Table 11-13 will be placed on the BWAS turntable and an assay initiated. Results of each box type shall be recorded on OSCR (Data Sheet 5) forms.

Table 11-12
Target Radionuclide Loadings for the Large Box Loaded with Heavy
Density Matrix Simulant

¹³⁷ Cs (μCi)	⁶⁰ Co (μCi)	²³⁹ Pu Equiv	Source IDs
25	50	69 mg	CS24.1, CO46.4, PSC9.8, PSC29.6, PSC30.1
50	25	347 mg	CS54.1, CO24.9, PSC2.3, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
1750	150	1.04 g	CS559, CS1194, CO104.7, CO46.4, PSC9.8, PSC30.1, PSC493.0, PSC504.4
5	5	3.47 g	CS4.4, CO4.7, PSC29.6, PSC479.0, PSC480.9, PSC493.0, PSC495.4, PSC497.7, PSC502.7, PSC504.4
1000	350	10.41 g	CS1194, CO104.7, CO271, SGC10, PSC3.4, PSC9.8, PSC14.0, PSC19.9, PSC29.6, PSC30.1, PSC191.1, LLWSTD1, LLWSTD2, LLWSTD3, LLWSTD4, LLWSTD5
500	1750	50 g	CS559, CO271, CO547, CO971, STD3
350	75	100 g	CS54.1, CS292, CO24.9, CO46.4, SGC100
1500	750	200 g	CS292, CS1194, CO271, CO547, STD3, SGC30, STD3, SGC100
750	500	400 g	CS292, CS559, CO547, STD3, SGC100, SGC250
500	500	600 g	CS559, CO547, SGC100, STD9
1250	1500	1 kg	CS54.1, CS1194, CO547, CO971, TBD
1940	1940	2 kg	CS103.7, CS559, CS1194, CS4.4, CS24.1, CS24.1, CS54.1, CO104.7, CO271, CO547, CO971, CO46.4, TBD

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Table 11-13
Off-Standard Box Dimensions

Box Number	Length (feet)	Width (feet)	Height (feet)
1	10	5	5
2	8	5.5	5
3	8	5	5.5

In addition, completion of this off standard condition test will be witnessed by cognizant LANL and WHC representatives in the spaces provided below. WHC concurrence may be performed via FAX transmission. In order to limit Test Procedure delays, WHC concurrence shall be made within four hours of the Off-Standard Condition Test or within four hours of notification of the measurement results, whichever comes last.

Off Standard Condition Test Verification:

_____
Signature of LANL Witness

_____
Date

_____
Signature of WHC Witness

_____
Date

11.13 CALIBRATION OF PLATFORM SCALES

At the completion of all box measurements, the calibration of the platform scales used to determine the weights of the boxes and matrix simulants will be verified by completing the hold point below. If the calibration of the platform scales is inaccurate, an anomaly has occurred and the provisions of Section 10.5 of this Test Procedure apply.

Hold Point:

_____
Signature of LANL QA Witness

_____
Date

11.14 COMPLETION OF TEST PROCEDURE

Cognizant WHC and LANL representatives will indicate their concurrence in the spaces provided below that all tests listed in Sections 11.1 through 11.13 of this Test

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Procedure have been completed.

Test Completion:

Signature of WHC Representative

Date

Signature of LANL Representative

Date

12.0 DISPOSITION OF BWAS AFTER TESTING

Soon after completion of all tests discussed in this Test Procedure, the BWAS will be disassembled into its components and swiped for contamination. If no contamination is found, the system will then be shipped to WHC. If contamination is found, the contamination will be removed from the component, if possible, then shipped to WHC. If it is not possible to remove the contamination, then the component will be discarded as radioactive waste.

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13.0 DATA SHEETS

Data Sheet 1. Test Anomaly Report for BWAS evaluation at LANL. This sheet references Sections 2.2 and 10.5 in the Test Procedure text.

BWAS ACCEPTANCE/QUALIFICATION		REPORT #:	DATE:	Page of
ITEM	DESCRIPTION OF ANOMALY			
Originator's Signature		Date		

DISPOSITION APPROVAL SIGNATURES:

LANL Test Director:	Date
PSC Technical Representative:	Date
WHC Cognizant Engineer	Date

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Data Sheet 2. BWAS ES & H Inspection Report form. This sheet references Section 11.1 of the Test Procedure text.

BWAS ES & H INSPECTION REPORT

Date _____

ES & H Inspection Objective _____

Inspector Signature _____

Inspector Organization _____

ES & H INSPECTION CONCERNS

ITEM	DESCRIPTION OF ES & H CONCERN	RECOMMENDED DISPOSITION

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RESOLUTION OF ES & H CONCERNS

ITEM	ACTION TAKEN TO RESOLVE CONCERNS	DATE	DISPOSITION

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Data Sheet 3. Measurement Data Sheet form. This sheet is referenced in Section 11 of this Test Procedure.

Measurement Data Sheet

Date _____ Time _____
Temperature _____ Humidity _____

Test Objective _____
Test Procedure Section _____
Total Measurement Time _____
Measurement Personnel _____

Waste Box Data

Box Size _____ Box Weight _____
Box Location (from HPGe Detector) _____

Preliminary Measurements

Measurement of Empty Box Without Sources

Gamma-Ray Results _____
Neutron Results _____

Pink Box Measurement Results

Gamma-Ray Results _____
Neutron Results _____

Calibration Data

Neutron Calibration:

Calibration Type _____ Calibration Date _____

Gamma-Ray Calibration

Calibration Type _____ Calibration Date _____

Observed Anomalies

Anomaly Resolution _____
_____

Witness Signature (if needed) _____

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Source Loading

¹³⁷ Cs Activity(μCi) and Location (x,y,z)	⁶⁰ Co Activity(μCi) and Location (x,y,z)	²³⁹ Pu (or Equivalent) Grams and Location (x,y,z)

Measurement Results

	Gamma-Ray Measurement	Neutron Measurement	
		Passive Mode	Active Mode
Measurement Time/Repetitions			
Matrix Correction Factor			
¹³⁷ Cs Assay Result			
⁶⁰ Co Assay Result			
²³⁹ Pu Equivalent Assay Result			
Waste Category Assignment			

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Data Sheet 4. BWAS Gamma-Ray System Tests form. This sheet references Section 11.6 in the Test Procedure text.

BWAS GAMMA-RAY SYSTEM TESTS

Date_____ Time_____

Temperature_____ Humidity_____

Test Objective_____

Test Procedure Section_____

Instrument Type (NaI or HPGe)_____

Measurement Personnel_____

Measurement Time_____

Empty Waste Box Type_____

GAMMA-RAY TEST RESULTS

Source Information		
Isotope(s)	Activity (Effective Date)	Source Location

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Gamma-Ray Peaks		
ROI Peak Width (kev)	Total Counts	Net Counts

Resolution			
	Peak (kev)	Total Counts in Peak Channel	Resolution (kev)
FWHM			
FWTM			
FW0.2M			

Peak to Compton				
Peak (kev)	Net Counts in Peak	Flat Region		Peak to Compton Ratio
		Width (kev)	Total Counts	

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Data Sheet 5. Off Standard Conditions Report (OSCR) form. This sheet is referenced in Sections 11.8 and 11.13 of this Test Procedure.

OFF STANDARD CONDITIONS REPORT

Date _____ Time _____
Temperature _____ Humidity _____

Test Objective _____
Test Procedure Section _____

Measurement Personnel _____

Off Standard Condition Test _____

Test Conditions

Box Type _____
Matrix Type and Weight _____
Source Loading _____
Source Location _____

Test Results _____
_____
_____
_____

Assay Value _____

Witness Signature (if needed) _____

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14.0 REFERENCES

W.P. Gilles, *Specification for Boxed Waste Assay System*, Westinghouse Hanford Co. Document WHC-S-033, Rev 5, May 1994.

S.W. Shaw, *Test Specification for Qualification/Acceptance Testing of a Boxed Waste Assay System by Los Alamos National Laboratory*, Westinghouse Hanford Co. Document WHC-SD-W026-TS-001, Rev 1, June, 1994.

Solid Waste Acceptance Criteria, Westinghouse Hanford Co. Document WHC-EP-0063-4.

Environment, Safety, and Health Manual, Los Alamos National Laboratory Document, Chapter 1, US DOE Contract W-7405-ENG.36, June, 1990.

ATTACHMENTS

Attachment A. Copy of ES&H Questionnaire and M.Gaye Barnes memo HSE-Q-93-0159 with checklist. - see Sec 6.0

Attachment B. cy of EM-8-93-2220 including the cover memo and environmental checklist and cy of EM-8-93-2760

Attachment C. Memo of Closure from Jeff Carmichael - EM-8: 93-2523

Attachment D. Memo of Closure from Doug Stavert, EM-8:93-2661

Attachment E. Memo of Closure from Glenn Neely, HS-1:93-584

Attachment F. Memo of Closure from Kevin Smale, HS-9:93-238

Attachment G. Memo from Rosemary Glenn, EM-7G: 93-422

Attachment H. Memo of Closure from Patrick Josey, NMT-04-93-375

Attachment I. Memo from Stewart Vessard, HS-6-93-175

Attachment J. Memo of Closure from Sharon Aragon, HS-5-93-1075

ATTACHMENT A

ATTACHMENT A

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: JOE WACHTER, NMT-4, MS E513
THRU: M. R. Heineman, HS-3
FROM: M. Gaye Barnes, HS-3
SUBJECT: ES&H PROJECT CHECK LIST

DATE: August 5, 1993
MAIL STOP/TELEPHONE: K479/5-5444
SYMBOL: HSE-Q-93-0159

CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM
ES&H QUESTIONNAIRE # 93-0159
ENG PROJECT ID # 93-NONE

As per Environment, Safety, and Health (ES&H) Administrative Requirement 1-10, the Laboratory ES&H Questionnaire Committee has reviewed your ES&H Questionnaire to identify potential environment, safety, and/or health requirements. It is your responsibility as line management to make the contacts specified on the attached ES&H Project Check List and to ensure that ES&H issues brought up by the committee are resolved. You must also develop and maintain a permanent file meeting DOE requirements that documents the resolution of these issues.

Costs for services specific to your undertaking which exceed those normally provided by indirect funding will be charged to the project.

When making the contacts requested on the Check List, please specify that you are calling in reference to an ES&H Project Check List and mention the ES&H Questionnaire number and the ENG project identification (PI) number for your project.

Please note that each check list contact has an individual status description which is defined on the attached sheet.

PLEASE NOTE: THIS CHECKLIST MAY NEED REVISION IF THERE ARE CHANGES IN THE SCOPE OR LOCATION OF YOUR PROJECT.

(pcktext)

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CHECK LIST STATUS DESCRIPTION

REQUIRED

ES&H activities related to the check list will begin only after you call the listed contact(s) and discuss the project to determine what, if any, special ES&H requirements will be necessary for the project to proceed. Items needing approval by external agencies may take 3-4 months.

AREA OF CONCERN

If the project is going to proceed, please call the listed contact(s) to discuss ES&H concerns that must be considered during the first stages of design.

UPDATE

Please call the contact listed who will instruct you regarding review of existing safety documentation.

IN PROCESS

Action is being taken by the appropriate personnel. if you need further assistance, please direct your questions to the individual listed.

COMPLETE

The ES&H concern noted is complete, and no action is required on your part. Documentation will be sent by the individual listed.

E S & H PROJECT CHECK LIST
CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM

I. EXTERNAL (NON-LABORATORY) APPROVAL REQUIRED

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) REVIEW IN PROCESS

Approval: DOE

Contact : Peggy Powers, EM-8, 5-5717

RESOURCE CONSERVATION & RECOVERY ACT (RCRA)

REVIEW FOR RADIOACTIVE WASTE REQUIRED

Approval: DOE

Contact : Jeff Carmichael, EM-8, 5-2505

AIRBORNE RADIOACTIVE EMISSIONS

REVIEW FOR EPA EXEMPTION OR APPROVAL REQUIRED

(Radioactive National Emission Standards for
Hazardous Air Pollutants (RAD NESHP)

Approval: Environmental Protection Agency (EPA)

Contact : Doug Stavert, EM-8, 5-0235

II. LABORATORY ACTION REQUIRED

OCCUPATIONAL RADIOLOGICAL SAFETY ASSESSMENT REQUIRED

Contact: Glenn Neely, HS-12, 7-5296

RADIOACTIVE AIR EMISSIONS MANAGEMENT REVIEW REQUIRED

Contact: Kevin Smale, HS-9, 5-2169

REVIEW FOR SOLID RADIOACTIVE WASTE IS IN PROCESS

Contact : Johnny Krueger, EM-7, 5-8467

REVIEW FOR WASTE MINIMIZATION PLAN REQUIRED

Contact : Hilary Noskin, EM-DO, 5-8289

CRITICALITY REVIEW REQUIRED

Contact : Stuart Vessard, HS-6, 5-2817

HS-5 OPERATIONAL SAFETY REVIEW IN PROCESS

Contact : Fred Bolton, HS-5, 104-3914

E S & H PROJECT CHECK LIST
CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM

Attachment: ES&H Questionnaire No. 93-0159

Distribution:

R. Holmes, NMT-8, MS E583, w/att.
P. Pan, NMT-8, MS E583, w/att.
S. Vessard, HS-6, MS F691, w/o att.
G. Neely, HS-12, MS K483, w/o att.
K. Smale, HS-9, MS E528, w/o att.
H. Noskin, EM-DO, MS K472, w/o att.
J. Krueger, EM-7, MS J595, w/o att.
J. Carmichael, EM-8, MS K490, w/att.
P. Powers, EM-8, MS K490, w/o att.
D. Stavert, EM-8, MS K490, w/att.
Quest. File 93-0159 w/att. (orig.)
(dcklistd/pcklistd)

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

JOE WACHTER, NMT-4, MS E513

July 12, 1993

M. Gaye Barnes

DATE

K479/5-53638

FROM

HSE-Q-93-0159

MAIL STOP TELEPHONE

SYMBOL

ES&H PROJECT SUMMARY AND QUESTIONNAIRE

SUBJECT

PROJECT : CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM
TA/BLDG : 54/0
LAB JOB # : 93-NONE
QUEST. # : 93-0159

Please complete the attached ES&H Questionnaire which will be reviewed by the ES&H Questionnaire Committee for any potential federal, state, local, Laboratory or DOE ES&H concerns or requirements. You will be advised of potential problems which may impact your project.

Some regulations requiring site characterization permitting, or environmental documentation may take six or more months to complete; therefore, your early input into the questionnaire process is vital. Please return the completed questionnaire form to M. Gaye Barnes, HS-3, MS K479. You will be informed by memo of the date, time, and place of the ES&H Questionnaire committee meeting at which your project will be reviewed.

NOTE: Please submit a COMPLETE DESCRIPTION OF YOUR PROJECT ALONG WITH ANY SUPPORTING DOCUMENTATION AVAILABLE. The information submitted will determine what level of initial review can be accomplished by the committee. SUFFICIENT INFORMATION COULD POSSIBLY ELIMINATE SOME OF THE ES&H CONCERNS THAT WILL REQUIRE FURTHER FOLLOW-UP ON YOUR PART.

MRH/gb

Information cy: w/o attachments
NEPA, MS K490
Quest. File 93-0159
HSE-PQF
NESHAP, EM-8, MS K490

(phseques)

Questionnaire Number
93-0159
Project Identification (Lab Job number)
93-NONE
Date Sent
July 12, 1993

INSTRUCTIONS

1. Type, print, or legible handwriting is acceptable (use a black ink pen).
2. Provide only unclassified information. Contact HSE-3 at 7-2703 for submittal instructions for classified projects.
3. Return to M.R. Heineman, HSE-3, Mail Stop K479

Completed By (Print Name)	Group	Mail Stop	Phone
Joseph Wachter	NHT-4	ES13	5-1977
Signature			Date
Joseph Wachter			7/12/93
User Contact (If Not The Same As Above)	Group	Mail Stop	Phone
Engineering Construction Project Manager (Name)	Group	Mail Stop	Phone
Project Title			
CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM			
Brief Description of Project (Provide Attachment if Desired)			
TA-55 is to perform a characterization of a neutron-based waste measurement system that is being fabricated for the WRAP facility at Westinghouse - Hanford Co.			

1. LOCATION (Check All That Apply)

IMPORTANT: Attach a map if project is not inside an existing LANL facility. (Check with your ENG-1 contact or ENG-5 area coordinator to obtain)

☒ Los Alamos National Laboratory

TA 55

☒ Inside Building TA 55 Room Basement

☐ Outside

To the best of your knowledge does this site? (Check All That Apply)

☐ Have ENG-2 approval?

☐ Have solid waste management units (SWMUs)?

☐ Require new roads?

☐ Require new or additional parking? Number of vehicles? _____

☐ Require use of vehicle on dirt trails and/or off-road?

☐ Reside in or adjacent to a canyon?

What is the approximate size of the site (disturbed area)? _____ ft. X _____ ft.

☐ Require Security?

☐ Industrial ☐ Operational

☐ Require that a fence be erected or moved?

☐ Require removal of trees?

☐ Nevada Test Site

Area _____ Building _____ Room _____ ☐ Other* _____

☐ White Sands Missile Range*

☐ Sandia National Laboratory (Albuquerque)*

☐ Other* _____

Provide a legal description with Township/Range/Section and attach a map for any of the boxes you check below.

☐ Bureau of Indian Affairs

☐ San Ildefonso* ☐ Santa Clara* ☐ Other*

☐ Bureau of Land Management*

☐ County Land

☐ Los Alamos* ☒ Sandoval* ☐ Santa Fe* ☐ Other*

☐ National Park Service

☐ Bandelier* ☐ Other*

☐ Private Land*

☐ United States Forest Service*

*Description/Location

2. PURPOSE (Check All That Apply)

- ☐ Correct Safety Violation ☐ Regulatory Compliance ☐ Equipment Maintenance ☒ New Program ☐ Other (Specify) _____

WHC-SD-WOOD-1C UDA REV U

3. FUNDING (Check All That Apply)

Total Amount in K\$ _____

Starting Fiscal Year _____

Project Dates

☐ Line Item

☐ GPP

☐ Expense

☐ Operational

☐ ER Corr./Act.

☒ Other

Start Construction

Start Operations

Dec / / 93

Programmatic Importance (DOE/ENG-8 Criteria)

☐ Critical ☒ Vital ☐ Important ☐ Moderate

Funding Source

Department of Energy (Specify Funding Sponsor) _____

Department of Defense (Branch) _____

Other (Specify Funding Sponsor) Westinghouse Hanford Co.

4. RELATED PROJECT/PROGRAMS

- ☐ Project is related to or a part of another Laboratory program? List related programs below.
☐ Project has more than one case? List related phases below and attach phasing information.
☐ Project is related to or part of another Laboratory project? List related project below.
 Attach An Additional Page If Necessary

Program/Project/Phase

Project ID : Lab Use

5. PROJECT/PROGRAM TYPE (Question 5 consists of subsections 5.1-5.6.)

- ☐ New Facility or Construction Project?
 5.1 ☐ Relocation of an Existing Operation to a New Facility?

Size of Facility _____ (Total sq. ft.) Number of stories _____

Number of new employees to be housed _____ (Not Construction Employees)

Will special decommissioning requirements be required upon termination of project operations? ☐ Yes ☐ No

Type of Facility (Check All That Apply)

☐ Permanent Construction

☐ Transportable

☐ Landfill

(Check Landfill Type Below)

☐ Sanitary

☐ Hazardous Waste

☐ Mixed Waste

☐ Radioactive Waste

☐ Permitted Treatment (EPA/EID)

☐ Transporter

☐ Permitted Storage (EPA/EID)

(Check Storage Type Below)

☐ Hazardous Waste ☐ Mixed Waste

☐ Product Storage (Type) _____

☐ Utility

☐ Parking

☐ Fence

☐ Trailer

☐ Tower

☐ Fence

☐ Other _____

5.2 ☐ Building Addition to an Existing Facility?

Existing Facility (Check All That Apply)

Approximate date existing facility was built _____

☐ Transportable

☐ Facility has an existing Safety Analysis Report (SAR).

☐ Permanent Construction

New Addition (Check All That Apply)

Size of addition _____ (Total sq. ft.) Number of stories _____

Number of new employees (not construction employees) to be housed? _____

☐ Roads or parking will be required.

☐ Special decommissioning will be required after completion of project operation

Are modifications needed to any of the following existing critical safety systems? (Check All That Apply)

☐ Utilities

☐ Industrial Ventilation

☐ Shielding

☐ Heating Vent., & Air Conditioning (HVAC) Sys

☐ Electrical

☐ Fire Protection

☐ HEPA Filters

☐ Continuous Air Monitors (CAMs)

☐ Generators

☐ Air Monitoring

☐ Criticality Alarm Systems

☐ Other Introduce 480V 3Ø

electric line.

5.3 ☐ Modification of an Existing Facility?

☐ Relocation of an Existing Operation to an Existing Facility?

Will the modifications involve any of the following? (Check All That Apply)

☐ Utilities	☐ Fire Protection	☐ HEPA Filters	☐ Spill Prevention
☐ Electrical	☐ Shielding	☐ Criticality Alarm Systems	☐ Moving/Installing Walls
☐ Generators	☐ Laboratories	☐ Continuous Air Monitors (CAMS)	☐ Heating, Vent., & A.C. HVAC
☐ Installing New Equipment (Type) _____			
☐ Other _____			

5.4 ☐ Decontamination/Decommissioning/Demolition project?

☐ The project will involve DECONTAMINATION of an existing facility.

Do you know if the facility ever used/contained any of the following? ☐ Yes ☐ No ☐ Unknown

☐ Radioactive Materials	☐ PCBs
☐ Toxic Materials	☐ Other _____
☐ Asbestos	

☐ The project will involve DECOMMISSIONING and reuse of an existing facility.

Indicate the intended use of the facility after decommissioning.

☐ Office	☐ Warehouse/Storage
☐ Laboratories	☐ Other _____

☐ The project will involve DEMOLITION of an existing facility.

The expected waste will contain (Check All That Apply):

☐ Perchlorates	☐ Radioactive Material
☐ Asbestos	☐ Toxic or Hazardous Material
☐ PCBs	☐ Other _____
☐ High Explosives	☐ Unknown What Waste Will Contain

☐ A part of the project is listed as a Solid Waste Management Unit (SWMU).

☐ Listed in the DOE 5 Year Plan for Waste Management
☐ Listed for Environmental Restoration
☐ Listed For Corrective Action

5.5 ☐ Nonconstruction Programmatic or Process Project?

Program or Process Name BWAS Evaluation

List Major Equipment Active/Passive Neutron Waste Crate Counter

Do any of the following apply to the program or process? (Check All That Apply)

☐ Existed in the Laboratory before 1977.	☐ Has been substantially altered or upgraded since 1977.
☐ Is an expansion of existing program.	☐ Is a modification or upgrade of an existing program.
☒ Is a new program/process of LANL.	☐ Direct transfer of an existing program/process to a new facility with change in operations.

Existing Facility TA _____ Building _____

5.6 ☐ Equipment Addition or a Move to a Facility That Has Not Already Been Covered by Subsections 5.1-5.5 Above

☐ Equipment to be used for building heat, light and power.

☐ Additional facility/building equipment? (Check All That Apply)

☒ Electrical	☐ Water/Sewer Utilities	☐ Spill Prevention
☐ Generators	☐ Fire Protection	☐ Heating, Ventilation, and Air Conditioning (HVAC) Systems
☐ Other _____		

☐ Additional experimental support equipment? (Check All That Apply)

☐ Electrical	☐ Water/Sewer Utilities	☐ Continuous Air Monitors (CAMS)
☐ Generators	☐ Radiation Shielding	☐ Heating, Ventilation, and Air Conditioning (HVAC) Systems
☐ Fire Protection	☐ HEPA Filters	☐ Criticality Alarm Systems
☐ Spill Prevention	☐ Other Filters _____	
☐ Other _____		

☐ Other _____

6. FACILITY OCCUPANCY (Check All That Apply)

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- ☐ Unoccupied
☐ Office
☐ Shop
☐ Warehouse
☐ Laboratories (Describe, e.g., Explosives, Laser, etc.)
- ☐ Electronics
☐ Storage - Chemical
☐ Storage - Other

☐ Other (Describe)

7. UTILITIES REQUIRED? (Check All That Apply)

- ☒ Electrical
☐ Potable Water
☐ Natural Gas
☐ Tanks (Type/Size)
☐ Above Ground
☐ Below Ground
☐ Other (Describe)
- ☐ Septic Systems
☐ Vacuum Systems
☐ Fire Protection
- ☐ Telephone
☐ Radioactive Liquid Waste (RLW) Line
☐ Data Communications
- ☐ Sanitary Sewer
☐ Industrial Water
☐ Breathing Air

8. WILL THE FACILITY/PROGRAM INVOLVE OR USE ANY MATERIALS BELOW? (Check All That Apply)

Hazardous materials to be identified should include materials posing a threat to personnel, the facility, or the environment because of their toxicity, carcinogenicity, flammability, explosivity, reactivity, etc.

The list below is not all inclusive, add to it as necessary.

Gases

	Maximum Used Per Year	Maximum Used Per Hour
☐ Hydrogen		
☐ Oxygen		
☐ Fluorine		
☐ HF		
☐ ClF ₃		
☐ Cyanogen		
☐ Nickel-Carbonyl		
☐ Arsine		
☐ Phosgene		
☐ Chlorine		
☐ Silane (Type)		
☒ Cryogenics (Type) <u>LN</u>	<u>50 L</u>	
☐ Inert Gases (Type)		
☐ Other (Type)		
☐ Other (Type)		
☐ Other (Type)		

Organic Materials

	Maximum Used Per Year	Maximum Used Per Hour
☐ Oil (Type)		
☐ Solvents (Type)		
☐ PCBs		
☐ Halogenated Hydrocarbons (Type)		
☐ Explosives/Propellants		
☐ Peroxide-Forming Compounds		
☐ Time-Sensitive Materials		
☐ Pesticides (Type)		
☐ Herbicides (Type)		
☐ Other (Type)		
☐ Other (Type)		
☐ Other (Type)		

Inorganic Materials Maximum Used
Per Year Per Hour

☐ Perchloric Acid, Perchlorates	_____	_____
☐ Concentrated Acids (Type) _____	_____	_____
☐ Concentrated Bases (Type) _____	_____	_____
☐ Pyrotechnic Materials (Type) _____	_____	_____
☐ Heavy Metals (Type) _____	_____	_____
☐ HF	_____	_____
☐ Cyanides	_____	_____
☐ Sulfides	_____	_____
☐ Other (Type) _____	_____	_____
☐ Other (Type) _____	_____	_____
☐ Other (Type) _____	_____	_____
☐ Other (Type) _____	_____	_____

Suspected Human Carcinogens

(Confirmed Animal Carcinogens)

Maximum Used
Per Year Per Hour

☐ Acrylamide	_____	_____
☐ Antimony Trioxide Production	_____	_____
☐ Arsenic Trioxide Production	_____	_____
☐ Benzo (a) Pyrene	_____	_____
☐ Beryllium	_____	_____
☐ 1,3-Butadiene	_____	_____
☐ Carbon Tetrachloride	_____	_____
☐ Chloroform	_____	_____
☐ Chromates of Lead and Zinc	_____	_____
☐ Chrysene	_____	_____
☐ Dimethylcarbamoyl Chloride (DMCC)	_____	_____
☐ 1,1-Dimethylhydrazine	_____	_____
☐ Diethyl Sulfate	_____	_____
☐ Ethylene Dibromide (EDB)	_____	_____
☐ Hexachlorobutadiene	_____	_____
☐ Hexamethyl Phosphoramide (HMPA)	_____	_____
☐ Hydrazine	_____	_____
☐ 4,4'-Methylenbis (2-Chloroaniline), (MOCA)	_____	_____
☐ Methylene Chloride	_____	_____
☐ 4,4'-Methylenedianiline	_____	_____
☐ Methyldiazine	_____	_____
☐ Methyl Iodide (Iodomethane)	_____	_____
☐ 2-Nitropropene	_____	_____
☐ N-Phenyl-Beta-Naphthylamine	_____	_____
☐ Phenylhydrazine	_____	_____
☐ Propane Sulfone	_____	_____
☐ Propylene Imine	_____	_____
☐ O-Tolidine (DMB)	_____	_____
☐ O-Toluidine	_____	_____
☐ P-Toluidine	_____	_____
☐ Vinyl Bromide	_____	_____
☐ Vinylcyclohexane Dioxide	_____	_____
☐ Other (Type) _____	_____	_____
☐ Other (Type) _____	_____	_____
☐ Other (Type) _____	_____	_____

Confirmed Human Carcinogens Maximum Used
Per Year Per Hour

☐ Asbestos	_____	_____
☐ Chromate (Chromite Ore Processing)	_____	_____
☐ Chromium (VI), Certain Water Insoluble	_____	_____
☐ Compounds	_____	_____
☐ Coal Tar Pitch Volatiles	_____	_____
☐ Nickel, Fume and Dust (Sulfide Roasting)	_____	_____
☐ Zinc Chromates	_____	_____

Biological Hazards

Biological hazards arise from the potential of a biological agent to cause illness or systemic injury or dysfunction through the release of toxins, poisons, into the body.

The following classifications of infectious or other biological agents to be stored or used in this facility. (Check All That Apply)

☐ Viral and Rickettsial

(Describe) _____

☐ Bacterial

(Describe) _____

☐ Fungal

(Describe) _____

☐ Parasitic

(Describe) _____

☐ Recombinant DNA or DNA-Altering Chemicals

(Describe) _____

☐ Processes Involving Human Body Fluids or Tissue

(Describe) _____

☐ Other

(Describe) _____

☐ Yes ☒ No WILL CENTRAL CHEMICAL STORAGE BE PROVIDED FOR MATERIALS INDICATED IN QUESTION 8

9. WILL THE FACILITY/PROGRAM INVOLVE OR USE ANY RADIONUCLIDES BELOW? (Check All That Apply)

Radionuclides	Isotope (s)	Quantity (Per Unit Of)	Time
☒ Plutonium	^{239}Pu , ^{240}Pu	~ 1 Kg	Year
☒ Americium	^{241}Am	~ 1 g	Year
☒ Uranium	^{235}U	~ 600 g	Year
☐ Thorium			
☐ Iodine			
☐ Fission Products (Mixed)			
☐ Activation Products (Mixed)			
☐ Phosphorus			
☐ Sulfur			
☐ Tritium			
☐ Sources			
(Type) ^{252}Cf		100 μCi	Year
☐ Other			
(Type)			
☐ Other			
(Type)			

10. EFFLUENT/WASTE GENERATION. WILL THE PROGRAM/FACILITY/PROJECT GENERATE ANY OF THE FOLLOW
(Question 10 consists of subsections 10.1-10.5)**10.1 New or Altered Airborne Emissions? (Check All That Apply)**

	New Source	Altered Source	Quantity (Per Unit Of)	Time
☐ Non-Hazardous	☐	☐		
☐ Toxic	☐	☐		
☐ Hazardous	☐	☐		
☐ Radioactive	☐	☐		

10.2 New or Altered Liquid Effluents? (Check All That Apply)

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	New Source	Altered Source	Quantity (gal.)	Approximate (Per Unit Of)	Time
☐ Industrial Waste Systems	☐	☐			
☐ Cooling Water Blowdown					
☐ Photo Processing					
☐ High-Explosives Processing					
☐ Radioactive Waste					
Type _____					
☐ Once-Through Cooling					
☐ Other _____					

	New Source	Altered Source	Number of People
☐ Sanitary Wastewater			
☐ Central Collection System	☐	☐	
☐ Septic Systems	☐	☐	
☐ Holding Tanks	☐	☐	

	New Source	Altered Source	Storage Tanks (Circle One)*	Gallons	Approximate (Per Unit Of)	Time
☐ Chemical Waste	☐	☐	B S T			
Describe _____						
☐ Industrial Waste	☐	☐	B S T			
Describe _____						
☐ Radioactive Waste	☐	☐	B S T			
Describe _____						
☐ Product	☐	☐	B S T			
Describe _____						
☐ Other	☐	☐	B S T			
Describe _____						

*B = Buried S = Surface T = Transportable

10.3 New or Altered Solid Waste? (Check All That Apply)

	New Source	Altered Source	Volume	Amount (Per Unit Of)	Time
☐ Solid Waste					
☐ Sanitary Landfill Trash	☐	☐			
☐ Toxic or Hazardous Waste	☐	☐			
☐ Medical	☐	☐			
☐ Carcinogenic	☐	☐			
☐ Biohazardous	☐	☐			
☒ Radioactive Waste (List Isotopes)					
☐ HLW	☐	☐			
☐ TRU	☐	☐			
☒ LW ^{239}Pu ^{240}Pu	☐	☐	0.5 Pu		Year

10.4 New or Altered Hazardous/Mixed Waste?

	New Source	Altered Source	Volume	Amount (Per Unit Of)	Time
☐ Solid	☐	☐			
☐ Liquid	☐	☐			
Describe _____					

10.5 Short-Term Waste Storage Area On Site?

☐ Short-Term (Describe Below)

10.6 Other Waste?

☐ Other Waste (Describe Below) Attach An Additional Page If Necessary.

10.5 Are Features or Actions in Place or Planned to Mitigate or Remediate the Effects of Building the Facility or the Performance of Activities? (Check Those Anticipated)

- ☐ Release monitoring instrumentation: what type of releases are being monitored? _____
- ☐ HEPA or other particulate filters: how many stages? _____
- ☐ Carbon or other type of filters: if so, what type, and what is mitigated? _____
- ☐ Scrubbers
- ☐ Spill Prevention and Secondary Containment Features
- Waste Handling and Minimization Plan (Check One)
- ☐ Completed And Implemented ☐ Being Revised
- ☐ Covered By Another Document (Specify) _____

11. WILL THE FACILITY/PROGRAM INVOLVE ANY OF THE FOLLOWING ENERGY SOURCES?

(Question 11 consists of subsections 11.1 - 11.11) (Add attachments as necessary)

11.1 High Current/Voltage Electrical Sources? (Check All Applicable)

- ☐ Shock ☐ Power Outage ☐ Arcing ☐ Ignition of Combustibles
- ☐ Burns ☐ Overheating ☐ Electrostatic Discharge ☐ Inadvertent Activation

Describe

480 V 3Ø Electric Line

11.2 Mechanical Energy Sources? (Check All Applicable)

- ☐ Sharp Edges/Points ☒ Lifting Weights ☐ Ejected Parts/Fragments ☐ Pinch Points
- ☐ Rotating Equipment ☐ Stability/Topping ☐ Crushing Surfaces ☐ Reciprocating Equipment

Describe

System weighs ~ 10,000 lb and has dimensions 10' x 12' x 32'

11.3 Pneumatic/Hydraulic Pressure Energy Sources? (Check All Applicable)

- ☐ Overpressurization ☐ Backflow ☐ Hydraulic Ram ☐ Pipe/Hose Whip
- ☐ Pipe/Vessel Rupture ☐ Propelled Objects ☐ Mislocated Relief Device ☐ Blast/Blast Overpressure
- ☐ Implosion ☐ Inadvertent Release ☐ Thrown Fragments

Describe

11.4 Acceleration/Deceleration Energy Sources? (Check All Applicable)

- ☐ Inadvertent Motion ☐ Fragments/Missiles ☐ Impacts ☐ Slip/Trip
- ☐ Loose Objects ☐ Sloshing Liquids ☐ Falling Objects ☐ Falls

Describe

11.5 Heat/Temperature Energy Sources? (Check All Applicable)

- ☐ Heat Source/Sink ☐ Elevated Reactivity ☐ Humidity/Moisture ☐ Elevated Volatility
- ☐ Hot/Cold Surface Burns ☐ Freezing ☐ Altered Structural Property
- ☐ Elevated Gas Pressures ☐ Reduced Reliability ☐ Elevated Flammability

Describe

11.6 Nonionizing Radiation Energy Sources? (Check All That Apply)

- ☐ Laser ☐ Microwave ☐ RF Field
☐ Ultraviolet ☐ Infrared

Describe

11.7. Ionizing Radiation Energy Sources? (Check All That Apply)

- ☐ X-Ray Generating Devices ☒ Sources

Describe ²⁵²Cf source 100 uCi

11.8 Fire/Flammability Energy Sources? (Check All That Apply)

- ☐ Fuel Present ☐ Oxidizer Present ☐ Ignition Source Present ☐ Propellant Present

Describe

11.9 Explosive/Propellant Energy Sources?

Initiators

- ☐ Heat
☐ Friction
☐ Vibration
☐ Impact/shock
☐ Electrostatic Discharge
☐ Lightning

Sensitizers

- ☐ Heat/Cold
☐ Vibration
☐ Impact/Shock
☐ Low Humidity
☐ Chemical Contamination
☐ Welding (Stray Currents/Sparks)

Effects

- ☐ Mass Fire
☐ Blast Overpressure
☐ Thrown Fragments
☐ Seismic Ground Wave

Conditions

- ☐ Explosive Propellant Present
☐ Explosive Gas Present
☐ Explosive Liquid Present
☐ Explosive Vapor Present

Describe

11.10. Chemical/Water Contamination Energy Sources? (Check All That Apply)

- ☐ System Cross-Conn ☐ Vessel/Pipe/Conduit Rupture ☐ Leaks/Spills ☐ Backflow/Siphon Effect

Describe

11.11 Physiological Effects Energy Sources? (Check All That Apply)

- ☐ Asphyxiants ☐ Irritants ☐ Fatigue ☐ Temperature Extremes
☐ Allergens ☐ Noise ☐ Vibration ☐ Lighting

Describe

11.12 Other Energy Sources?

- ☐ Other

Describe

12. Hazardous Material(s) Transportation

☐ Project will involve transporting hazardous material(s) in a motorized conveyance such as a truck or forklift.

The following materials are classified as Department of Transportation (DOT) regulated hazardous materials. Check all that apply.

☐ 1.1 Explosives	☐ 2.1 Flammable Gas	☐ 4.1 Flammable Solid	☐ 6.2 Infectious Substance Biological Hazards
☐ 1.2 Explosives	☐ 2.2 Non-Flammable Compressed Gas	☐ 4.2 Spontaneously Combustible Materials	
☐ 1.3 Explosives	☐ 2.3 Poisonous Gas	☐ 4.3 Materials - Dangerous When Wet	☐ 7 Radioactive Materials
☐ 1.4 Explosives	☐ 3 Flammable and Combustible Liquid	☐ 5.1 Oxidizers	☐ 8 Corrosive Materials
☐ 1.5 Very Insensitive Explosives: Blasting Caps	☐ 5.2 Organic Peroxides	☐ 9 Miscellaneous Hazard. Materials/ Other Regulated Material *	
☐ 1.6 Extremely Insensitive Detonating Substances	☐ 6.1 Poisonous Materials		

*Example: Materials that are regulated only as hazardous substance or hazardous wastes, and which do not meet the definition of any of the other hazard classes listed above.

- ☐ Onsite? On-site transfers are those transfers or movements of hazardous materials within an exclusion area, guarded at all times by some positive means which prevents access to the area by the general public. "General public" includes families of employees or any other non-employees in the area, not under official escort and control of an identified "Q" cleared employee. Movements within exclusion areas must be covered by SOPs that meet a level of safety equivalent to DOT.
- ☐ Off Site Vehicular shipments of hazardous materials over or across any roadway (or parking area) to which the public has free and unrestricted access, although technically within the Laboratory's boundaries, is considered "off-site" and subject to the full requirements of the Department of Transportation's regulations. Movements outside of exclusion areas must meet DOT and written procedures for such shipments must be reviewed and approved.

13. Other Potential ES&H Issues

Describe

Comments

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Dec. 11

7/8/93

Enclosed are a Conceptual Design Report (this is proprietary, so please be careful with it) and a Statement of Work. There are two documents give an overview of the instrument design and discuss the type of work to be performed with the instrument at LAUL, respectively. After reviewing the two documents, please contact me so we can discuss what type of safety assessment the instrument requires and the need for completion of an ESH Questionnaire.

Thanks

Joe Wichter

5-1977

FAX 5-6160

MEMO FROM BOB WEST

TO: Mike Bieri

FILE NO. WRP1092A.MMO

DATE: November 10, 1992

SUBJECT: Conceptual Design Report (CDR) For Hanford System

The following is a basic over view of the design for the Hanford WRAP system.

- Conveyor system is composed of a 10' Ø 180° rotating chain conveyor and a 21'-6" straight chain conveyor. The operation of the conveyor system will be controlled from either a local station or a remote station. The modes of operation for the conveyor will be both manual and automatic.
- The straight section of the conveyor will be contained within the assay enclosure.
- The assay enclosure will be segregated into three basic sections. These are:
  - The He3 section for neutron measurement,
  - The NaI section for general gamma measurement,
  - The HPGe section for specific gamma measurement.
- The electronics will be housed in three separate cabinets. One cabinet will contain the amplifiers, CAMACs and NIMBINS for the operations of the assaying instrumentation and will be located above the front end of the enclosure. ~~The local computer and manual operations controls will be contained in a floor level 19" vertical rack adjacent to the front end of the enclosure. The remote computer and manual operations controls will be contained in a control console located in the control room.~~

The following is a detailed description of the conceptual design.

- Plan view of system. See attachment #1
- Elevation view of system. See attachment #2
- The system is basically composed of: conveyor; door closure; lead in section; He3 section; MA section; NaI section; radiation source projection section; HpGe section; rear section; detector electronics; local control rack; remote control rack; and power panel section. The following is an outline description of these sections.
- Conveyor control sequence. See attachment #3 (5 pages)
- Conveyor specifications. See attachment #4 (4 pages)
- Conveyor cross section with enclosure. See attachment #5
- The loading and centering chute provided with the rotary table will be adjusted for the appropriate crate prior to loading.
- Pivot conveyor. See attachment #6 (3 PAGES)
- The crates will be loaded onto the pivot conveyor by fork truck. The pivot conveyor will contain a load centering guide chute and slave pallet. The guide chute must be set for the width of the crate to be loaded prior to loading. This is a manual operation. The slave pallet is necessary to accommodate the various crate widths and crate bottom constructions.
- Door closure. See attachment #7
- At the entry to the enclosure will be located a sectioned tracked door. The track will allow the door to move horizontally around to the MA side of the enclosure.
- Lead in section. There will be a non-active section at the front end of the enclosure. This section will be utilized to route electronic cables and act as a shielding section for the crate during neutron measurement.

There will be three modules which compose this section. There will be two vertical wall modules and one horizontal roof module. The roof module will support the detector electronics controls and amplifiers. All cables and wiring from the detectors and associated devices will be routed to the electronics cabinet with in the enclosure of this module. The ventilation unit for the electronics cabinet will be suspended on the side of this module.

These three units will contain the framework, polyethylene shielding and outer skin. These units will be shipped and assembled as three single units.

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- He3 section. The He3 detectors will be divided into four separate modules. These are:

- Roof module. See attachment #8
There will be three detector packages in the roof section. These packages will contain either 8 (in a single layer) or 15 (in a double layer) 6' He3 tubes. The section will be a single unit fabricated from 1/8" thick aluminum. This section will contain the detector packages, framework, polyethylene shielding, cables and outer skin. This section will be shipped and assembled as a single entity.

- MA side module. See attachment #9 (2 pages)
There will be two vertical detector packages, one on each side of the MA, with 8 (single row) or 15 (double row) 6 ft He3 tubes. There will, also, be two horizontal He3 packages with 8 (single row) or 15 (double row) 24" tubes, above and below the MA.

There will be four separate modules to accommodate the He3 detectors for the MA side. These modules will contain the framework, polyethylene, detectors, cables and outer skin. These modules will be shipped and assembled as complete units.

- Side wall module. See attachment #10
There will be a side wall module opposite the MA which will contain 2 detector packages. These packages will contain either 8 (single row) or 15 (double row) 6 ft He3 tubes.

These detector packages will be contained within a single unit which also contains the framework, polyethylene shielding and outer skin. This unit will be shipped and installed as a single entity.

- Floor module. See attachment #11
There will be three detector packages in a floor unit. These packages will be one of 8 or 15 tubes (8 ft), and two 5 or 9 tubes (6 ft) arrangements. This unit will be an assembly of these detector packages, the polyethylene shielding, and the framework. This unit will be suspended between the conveyor strands, below the slave pallet.

This unit will be shipped and installed as a single entity.

- Flux monitor. See attachment #12
There will be four flux monitors. Two will be located on the wall opposite the MA. There will be another two, one on each side of the MA on the same side as the MA.

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The flux monitors will be housed in an assembly which can be adjusted for the appropriate crate. The size selection is made at the terminal. The adjustment is implemented by electric motor driven cables. There will be ultra-sonic sensors which will detect the width of the crate upon entry into the enclosure. If this width matches the setting of the flux monitors the crate will be allowed to proceed.

The flux monitor assemblies will be attached to the inside of the He3 sections after these units have been set in place and secured.

- Helium 3 (He3) modules. See attachment #13

The He3 detector tubes will be contained in a solid polyethylene construction. Some arrays may be a double row of tubes and others a single row. The tubes will be configured in a manner which provides the best performance.

- MA section. See attachment #14

A neutron generator will be used during the active phase of the neutron measurement and imaging. The neutron generator will be housed in a moderating assembly (MA). The MA will be mounted onto a vertically movable or stationary platform depending upon test results which will determine the requirement.

- NaI section. See attachment #15 and attachment #16

There will be 16 NaI detectors for general gamma measurement. There will be four on the top, four on each side and four on the floor. Each NaI detector will be contained in a two inch thick lead shielding container. Each detector will be collimated by a series of concentric lead cylinders. Each NaI will have a removable lead back plate for installation and access.

See attachment #17

There will be four sub-assemblies to contain four NaI detectors each. Each sub-assembly will be composed of: four shielding/collimating assemblies, framework, polyethylene shielding and outer skin. These units will be shipped and installed as single entities. The NaI detectors will be shipped separately and installed on site.

- Radiation source projection section. See attachment #18

There will be 8 gamma sources which will illuminate 8 NaI detectors during active gamma measurement. There will be two systems of four sources. Each system will contain four sources attached to a single cable. The sources and the cable will be stored in a lead "pig" projector. The projector/storage container will also act as the source shipping container.

The sources will be extended from the projector by a motor driven cable into alignment with four respective NaI detectors. They will be guided into position by a straight tube which penetrates the collimators of four adjacent NaI detectors. The four NaI's which are opposite the sources will be illuminated. The four NaI's which have the sources in their collimators will not be looked at during the active measurement.

The Storage "pig" will be mounted in the roof module of the rear section. There will be one mounted on each side, over the wall modules for structural support.

The sources will be projected from the projector through a flexible guide tube to the fixed tube in the NaI shield/collimator. The motor drive for the cable will be housed in the roof module also. There will be a removable panel to access the cable motor drive and an emergency over ride system to retract the cable in the event of any failure.

- **HpGe section. See attachment #19**
There will be one HpGe detector for detecting gamma hot spots. The HpGe detector will be mounted onto a vertically movable platform. The HpGe detector will be shock mounted to minimize vibration background noise. The HpGe detector will be cooled by means of a cryo-electric unit. This unit will be housed in the rear section of the assay enclosure, between the conveyor chain strands and on the floor.
- **Rear section.** The rear section will be composed of four modules. These will include; two side wall units, one roof unit and one back wall unit. These will be to accommodate cables, radiation source system, and shielding. These modules will be single units which will contain their own framework, polyethylene and outer skin. These units will be shipped and assembled as four modules.
- **Detector electronics. See attachment #20**
The CAMACs, NIMBINS, and amplifiers associated with the He3, NaI, HpGe detectors and drive controls will be housed in an enclosure which will reside above the front end of the assay enclosure.
- **Local control.** Controls which will operate the system locally will be mounted in a single 19" rack. This rack is to be positioned at the front end, floor level, of the assay enclosure. This rack will contain; PSC 199 controller, two HV power supplies, scope, 486 rack mounted PC and monitor with pull out key board, laser printer, conveyor controls, door controls, MA elevation controls, HpGe elevation controls, source controls, and flux monitor controls.
- **Remote control.** Controls which operate the assay system from a remote location will be contained within a control room console. These controls will be a duplicate of those for the local control with the addition of closed circuit TV.

- Power panel section. There will be a power distribution panel located near the rear section on the out side of the enclosure. This panel will contain all circuit breakers and motor starters for the assay system.
- Structural calculations. See attachment #21 (5 pages)
The dimensions and configurations of all structural members will be determined by rigorous stress and deformation analysis. A minimum safety factor of two will be employed. Structural characteristics will be separated into; beams, columns, plates and cylinders.

Requirements for other considerations such as; radiation shielding, heat transfer, vibration, EMF/RFI attenuation and environmental requirements will be determined on the basis of the individual concern plus the structural needs.

The following items are to be furnished by others:

- Shielding all around the assay enclosure to provide both personnel protection from the radiation sources and generator used in the assaying process and to prevent back ground radiation from the environment interfering with the assay.
- Stops to prevent the fork truck operator from damaging the rotary table.
- Guides to ensure position accuracy of the fork truck loading.
- 10 KVA 480V 3Ø, and 5 KVA 120V 1Ø power to assay unit and 2 KVA 120V 1Ø power to remote controls.

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INNERLOCK LOGIC DIAGRAM

Attachment 3
5 Pages

PENTEK CONVEYOR

STATEMENT OF WORK, TESTING OF THE BWAS AT LANL

INTRODUCTION

Westinghouse Hanford Company (WHC) has contracted with Pajarito Scientific Corporation (PSC) for the design and fabrication of a Boxed Waste Assay System (BWAS), intended for use in the Waste Receiving and Processing (WRAP) facility at Hanford. The procurement specification (WHC-S-033) requires that qualification and characterization testing be performed to verify that the BWAS meets or exceeds procurement specification requirements.

The attached scope of work identifies BWAS Test program activities which would be performed at, and by Los Alamos National Laboratories (LANL).

BACKGROUND

The BWAS is a nondestructive assay system which uses Passive-Active Neutron (PAN), and Gamma Energy Analysis (GEA) techniques to assay waste boxes up to 8' long, by 5' wide and 5' tall. The overall dimensions of the device are approximately 33 feet long, 10 feet wide, and 12 feet high, with a total system weight of 40,000 pounds. Attachment 1, drawing number H-2-89510 is the system interface drawing for WRAP, and shows the device being loaded with a box from the side by a forklift.

The BWAS Qualification and Characterization Test Program will be performed in two distinct phases. The first phase will be testing completed at PSC facilities, and will primarily focus on the performance of the GEA portion of the instrument. The second phase, to be conducted at LANL, will emphasize the neutron assay portion of the instrument. The schedule for the test program is included as Attachment 2.

WORK SCOPE

BWAS Installation:

Make facility modifications as required to support installation and testing of the BWAS. This will include all activities and procurement necessary to prepare the test location for the BWAS. Provide craft, technical, security, safety and other support as required to facilitate PSC's installation of the BWAS at the test location.

Perform all analyses, safety, and operational reviews of readiness required to support the installation and testing of the BWAS at LANL. Design documentation required to support these activities shall be provided by PSC. Copies of all analyses performed are to be transmitted to WHC with the test report.

Provide office space and a phone for visiting WHC personnel supporting BWAS test activities.

Support System Verification and Calibration:

Perform required security and operational support to facilitate PSC in their verification and calibration of the BWAS prior to the initiation of testing.

Prepare Test Procedure to Specification Requirements:

WHC will provide a test specification which identifies required testing and data acquisition. Testing expected to be performed at LANL will consist of preparation of test boxes (boxes to be provided to LANL) of specified loading (see Attachment 3), and conducting assays of those boxes. Reported waste box inventories, source locations, and LLW categories, along with actual source loadings and arrangements within the box shall be reported.

In addition, testing shall be performed to demonstrate that the equivalent of:

- 2 Kg of plutonium passing within 10 feet of the BWAS,

or

- a container registering 200 mR/hr at the surface passing within 10 feet of the BWAS

will not effect assay accuracy, or will result in the cessation of any in-process assay.

As the test specification has yet to be generated, it is understood that cost estimates provided by LANL may require revision in the future to reflect any test specification requirements which differ significantly from the test criteria identified in this statement of work.

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REV 0Conduct Testing:

Provide personnel for the conduct of testing. Includes operation of the BWAS, preparation of test boxes to be assayed by the instrument, the documentation of the loading, source locations and resulting data, test log entries, and other activities specified by the test procedure. WHC will provide a cognizant scientist approximately 25% of the time who will serve an overview function in support of testing. In addition, the cognizant WHC test engineer and quality personnel will be available to support and overview test activities as required.

Prepare/Identify Sources for Testing and System Calibration:

Provide TRU source materials for incorporation into the test boxes. Attachment 3 identifies the sources required for testing. Three test boxes, a "Pink" verification box, waste matrix materials, fission and activation product sources will be provided by PSC.

Test Data:

The data obtained, and results of all LANL testing are to be shared equally among WHC, PSC, and LANL NMT-4 personnel; results may be published independently by any one of the parties, with the stipulation that the other parties will be consulted prior to publication.

Status Reports:

LANL shall provide periodic (approximately quarterly) written updates on the status of BWAS installation, testing, and removal, to the WHC project coordinator.

Prepare Test Report:

A test report shall be prepared by LANL for transmittal to WHC, which documents the testing performed, results, all test data and observations. WHC shall be given the opportunity to review and comment on the report prior to its formal transmittal to WHC.

Remove BWAS:

Support PSC in their effort to remove the BWAS from TA-55. Includes all activities necessary for radiological release of the BWAS for shipment to Hanford, and restoration of the test location to LANL requirements. PSC shall be responsible for shipping the BWAS to WHC. The BWAS shall be removed from TA-55 no later than March 31, 1995.

It is understood that LANL will take every precaution to avoid damage to the BWAS due to contamination or accidents. However, LANL will not be liable should either occur. Prior to the system's removal from the Plutonium Facility, LANL will remove all radioactive surface contamination and will perform a series of tests to assure the instrument is not contaminated.

Dispose of Waste:

Includes all activities necessary to dispose of waste generated as a result of BWAS Testing. It is currently estimated that 570 cubic feet of simulated waste matrix will require disposal as LLW.

Test Program Administration:

Provide a point of contact for WHC and PSC. Assist in the management of LANL related interfaces with PSC and WHC to ensure the orderly and effective conduct of the BWAS test program.

Quality Assurance:

All quality assurance functions related to the test program will be performed by the WHC organization. Required surveillances, and inspections will be performed by WHC prior to or during the testing phases. Any quality functions required by LANL, and not specifically identified in the test specification as pertinent to testing, shall be performed by LANL.

Other Tests

In addition to the formal test program, WHC plans to perform a "lump test" on a time-available basis. "Lump testing" will consist of performing assays with discrete plutonium sources of approximately 100 mg, 200 mg, 400 mg, 800 mg, 1.6 g, 3.2 g, and 12 g masses.

It is recognized and agreed that LANL may use the BWAS to perform assays of boxes of waste or other test boxes which are not part of the WHC test program. LANL agrees that these tests will not exceed the physical or Pu loading limits of the BWAS. The results of these tests are requested to be furnished to WHC. Publication of BWAS performance by LANL will require prior consultation with PSC and WHC.

Additional tests which PSC may wish to conduct will require WHC concurrence, will be performed on a time-available basis, and will not be funded by WHC.

WHC-SD-W026-TC-002
REV 0

Attachment 1
BWAS Interface Control Drawing

WHC-SD-W025-TC-002
REV 0

Attachment 2
BWAS Test Program Schedule

ATTACHMENT B

Los Alamos

WHC-SD-W026-TC-002

REV 0
ATTACHMENT B

Los Alamos National Laboratory

Los Alamos, New Mexico 87545

memorandum

TO: Joseph Wachter, NMT-4, MS E513

DATE: October 8, 1993

FROM: Jacie Siino, EM-8 *JS*

MAIL STOP/TELEPHONE: K490/5-5716

SYMBOL: EM-8:93-2760

SUBJECT: NEPA Categorical Exclusion for *Testing/Verification for the Boxed Waste Assay System*

EM-8 ACCESSION NO.: 4570
ES&H QUESTIONNAIRE NO.: 93-0159
DOE IDENTIFICATION NO.: LAN-93-052

The Department of Energy Field Office in Albuquerque (DOE/AL) has reviewed the DOE Environmental Checklist (DEC) for this activity and has categorically excluded this project from the requirement to prepare National Environmental Policy Act (NEPA) documentation.

Therefore, you may carry out the activities described in the DEC. DOE/AL, however, sends DEC's and the Area Manager's decisions to DOE Headquarters (EH-25) for review. If EH-25 overrules DOE/AL's decision, we will let you know as soon as DOE notifies us. In that case, further NEPA documentation will be required and the project schedule may be affected. We will not receive any notice if EH-25 upholds the categorical exclusion.

This categorical exclusion pertains only to NEPA requirements. The categorical exclusion is void if the proposed activity would

- violate state or federal laws, regulations, permit requirements, or DOE Orders,
- adversely affect cultural resources, threatened or endangered species, or floodplains and wetlands, or
- produce uncontrolled releases of hazardous substances, pollutants, contaminants, etc.

If you have a question about your project's compliance with environmental, safety, or health requirements, consult with the specialists identified on the ES&H Checklist. If an unresolved conflict or potential violation remains after completing these consultations, please call the NEPA staff for guidance.

If there is a change in the scope of this project, please call me so we can reevaluate the NEPA documentation.

JS:jm

Cy: R. Wagner, NMT-4, MS E513
G. Barnes, HS-3, MS K479
Cir. file

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Joseph Wachter, NMT-4, MS E513
FROM: Jacie Siino, EM-8 JS
SYMBOL: EM-8:93-2220
SUBJECT: **NEPA STATUS OF TESTING/VERIFICATION FOR THE BOXED WASTE ASSAY SYSTEM**

DATE: August 16, 1993
MAIL STOP/TELEPHONE: K490/5-5716

EM-8 ACCESSION NO.: 4570
ES&H QUESTIONNAIRE NO.: 93-0159
DOE IDENTIFICATION NO.: LAN-93-052

The enclosed Department of Energy (DOE) Environmental Checklist (DEC) was submitted to the DOE. The DOE reviews Laboratory projects to determine the documentation required by the National Environmental Policy Act (NEPA). The DEC is the initial document in the review process. The DOE will determine if:

- an Environmental Impact Statement (EIS) is required,
- an Environmental Assessment (EA) is required, or
- no further NEPA documentation is required.

The enclosed copies of the DEC and transmittal letter are for your information only.

You may not proceed with detailed design, construction (including site preparation), or project operations until all NEPA requirements are satisfied. We will let you know of DOE's determination as soon as they notify us.

The DOE ID Number, LAN-93-052, is to be included on planning, authorization, and control documents including Construction Project Data Sheets and activity data sheets for this project (Supplemental Directive DOE/AL 5440.1D, Appendix A).

Please call me if you have any questions about NEPA requirements.

JS:mmm

Enclosures: a/s

Cy: R. Wagner, NMT-4, MS E513, w/o enc.
Circ. File

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

DATE: August 6, 1993
IN REPLY REFER TO: EM-8:93-2175
MAIL STOP: K490
TELEPHONE: (505) 667-5021

Ms. Constance Soden
Acting NEPA Compliance Officer
U. S. Department of Energy
DOE Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

Ms. Diana Webb
NEPA Specialist
Environment, Safety, & Health Branch
U. S. Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico 87544

Dear Ms. Soden and Ms. Webb:

SUBJECT: DOE ENVIRONMENTAL CHECKLIST (1)

Enclosed is a Department of Energy (DOE) Environmental Checklist for the following proposed project:

*Testing/Verification for the Boxed Waste Assay System, Accession No. 4570,
LAN-93-052*

This checklist has been prepared following the format provided by DOE Field Office/Albuquerque (AL) for its use in determining the appropriate level of National Environmental Policy Act (NEPA) documentation.

We have identified potential environmental concerns in Block B of the checklist. If the project might cause a significant change in one of the standard entries, we have responded "yes" and provided clarification in the following text.

This action appears to be encompassed by the categorical exclusion for small-scale pilot projects (10 CFR 1021, Appendix B.3.10). However, this project is similar to what has been occurring at Technical Area 55, Building PF-4, for approximately 15 years. The only difference between this project and previous projects is the source of funding.

This action is funded by the Work for Others Program (DP 4.3).

The activities described appear to have insignificant environmental impacts and appear not to affect any sensitive areas. Please inform this office of action taken on this checklist.

*sent original
out on 8/12/93*

Sincerely,

Ann Pendergrass
NEPA Staff
Environmental Protection Group

August 6, 1993

AP/JS:es

Enclosure: a/s

Cy: A. Tiedman, ADO, MS A120, w/o enc.
T. Gunderson, EM-DO, MS J591, w/o enc.
J. Bellows, DOE/LAAO, MS A316, w/o enc.
J. Vozella, DOE/LAAO, MS A316, w/o enc.
E. Withers, DOE/LAAO, MS A316, w/enc.
CRM-4, MS A150, w/enc.
Circ. File

ENVIRONMENTAL CHECKLIST
U.S. Department of Energy
Albuquerque Operations Office

WHC-SD-W026-TC-002
REV 0

Project/Activity Title Testing/Verification for the Boxed Waste Assay System		ID NO: none ACC NO: 4570 DEC-93-0320	Date: 08/06/93
Program Office: Work for Others (DP 4.3)		B/R Code:	
A/O Contractor: Los Alamos Natl Lab		AL Tracking Number: LAN-93-052	
A/O Contractor Contact: LANL EM-8 Ann Pendergrass, 505-665-0458 Signature: <i>Ann Pendergrass</i>		Preparer (alt contact): LANL EM-8 Jacie Siino, 505-665-5716 Signature: <i>Jacie Siino</i>	
Project Line Management: Raymond P. Wagner, NMT-4, MS E513, 667-0645 Signature: <i>Victoria L. Longmire for Raymond P. Wagner</i>			
DOE/LAAO Line Management Official:			

A. BRIEF PROJECT/ACTIVITY DESCRIPTION: (See Block A, Page 2)

Category: Small-scale pilot project
Location: Technical Area 55, Building PF-4, Basement
Schedule: FY 94-95, ongoing
Cost: \$200K

B. ENVIRONMENTAL CONCERNS: (See Block B, Page 2)

	<u>Yes</u>	<u>No</u>		<u>Yes</u>	<u>No</u>
1. Air emissions	<u>x</u>	<u> </u>	13. Archaeological/cultural resources	<u> </u>	<u>x</u>
2. Liquid effluents	<u> </u>	<u>x</u>	14. Noise levels	<u> </u>	<u>x</u>
3. Solid waste	<u> </u>	<u>x</u>	15. Radiation/toxic chemical exposures	<u>x</u>	<u> </u>
4. Radioactive matls/soil	<u>x</u>	<u> </u>	16. Pesticide/herbicide use	<u> </u>	<u>x</u>
5. Hazardous constituents	<u> </u>	<u>x</u>	17. High energy sources/explosives	<u> </u>	<u>x</u>
6. Mixed waste (rad + haz)	<u> </u>	<u>x</u>	18. Transportation issues	<u> </u>	<u>x</u>
7. Chemical storage/use	<u> </u>	<u>x</u>	19. Special status species/environment	<u> </u>	<u>x</u>
8. Petroleum storage/use	<u> </u>	<u>x</u>	20. Identified ER site	<u> </u>	<u>x</u>
9. Asbestos materials	<u> </u>	<u>x</u>	21. Other	<u> </u>	<u>x</u>
10. Utility system	<u> </u>	<u>x</u>			
11. Clearing or excavation	<u> </u>	<u>x</u>			
12. Activity outside area fence/wildlife	<u> </u>	<u>x</u>			

C. PERMITS: (If response is Yes, an explanation is provided in Block C)

Does or may the proposed project/activity require any local, state, or federal permits, notifications, or reviews? Yes x No
Would the activity threaten a violation of laws, regulations, DOE Orders, or permits? Yes   No x

NCO DETERMINATION/RECOMMENDATION BLOCKS (D) AND EH OBJECTION/DETERMINATION BLOCK (E) ARE ON THE FINAL PAGE OF THIS DOCUMENT.

ENVIRONMENTAL CHECKLIST
DOE Albuquerque Operations Office
Testing/Verification for the Boxed Waste Assay System
DEC-93-0320, ACC NO. 4570

WHC-SD-W026-TC-002
REV 0

Block A: PROJECT/ACTIVITY DESCRIPTION

Construction Project Manager: None

Project Contact: Joseph Wachter, NMT-4, MS E513, 665-1977

Summary: This pilot project involves the testing and verification of a neutron-based waste measurement system, the Boxed Waste Assay System (BWAS). This system is being fabricated for the Waste Receiving and Processing (WRAP) facility at Hanford by a commercial enterprise, Pajarito Scientific Corporation.

Funding: This funding for this project is provided by Westinghouse Hanford Company. As this is a work for others project, the Work for Others Management Division (DP 4.3) will oversee this project.

Facility: This project will take place in Technical Area 55, Building PF-4, Basement.

Background: Calibration of nondestructive assay (NDA) measurement systems has been occurring at PF-4 for many years. Currently, there are approximately 40 NDA instruments that the Facility is using for testing their own plutonium waste. The Laboratory has been calibrating and using these NDA measurement systems for approximately 15 years.

Scope: The Boxed Waste Assay System is a nondestructive assay system which uses Passive-Active Neutron and Gamma Energy Analysis techniques to assay waste boxes up to eight feet long by four feet wide and four feet tall. The overall dimensions of the BWAS are approximately 33 feet long, 10 feet wide, and 12 feet high. The total system weight is approximately 40,000 pounds.

Pajarito Scientific Corporation (PSC) constructed the Boxed Waste Assay System for Westinghouse Hanford Company to be used in the Waste Receiving and Processing facility at Hanford. Los Alamos National Laboratory, through the Work for Others Program, has been contracted to evaluate this nondestructive assay measurement system. The evaluation will consist of calibrating the equipment using known quantities of various radionuclides and then testing the equipment with boxes of surrogate waste.

LANL has been asked to assist PSC in the installation of the BWAS by making slight facility modifications (adding 480 Volt electrical line) and to provide craft, technical, security, safety, and other support as required to facilitate Pajarito Scientific Corporation's installation of the Boxed Waste Assay System at the PF-4 basement test location. Personnel at the Laboratory will also perform all analyses, safety, and operational reviews of readiness required to support the installation and testing of the BWAS at PF-4.

Westinghouse Hanford Company will provide a test specification which identifies required testing and data acquisition. Testing expected to be performed at LANL will consist of preparation of surrogate test boxes of specified loading. Assays will be conducted of these boxes to calibrate and standardize the BWAS. All information about the testing conditions will be reported to Westinghouse. In addition, Westinghouse will support and oversee these tests using various scientists, engineers, and quality assurance personnel.

After all testing and calibration has been completed, Laboratory personnel will support Pajarito Scientific in their effort to remove the BWAS from PF-4. This support will include activities necessary for release of the Boxed Waste Assay System for shipment to Hanford. Any surface

ENVIRONMENTAL CHECKLIST
DOE Albuquerque Operations Office
Testing/Verification for the Boxed Waste Assay System
DEC-93-0320, ACC NO. 4570

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contamination will be removed prior to transport to Hanford; however, no contamination is expected to occur.

Similar testing and verification of nondestructive assay measurement instrumentation may be carried out in the future under the Work for Others program.

Block B: ENVIRONMENTAL CONCERNS

The intent of the Laboratory is to perform all activities in compliance with all applicable local, state, and federal regulations and orders. Wastes will be handled according to established Laboratory procedures that are intended to ensure compliance with regulations.

1. Air emissions:

A review for a preconstruction permit for the determination of radioactive air emissions is currently being done by the Air Quality & Meteorology section of EM-8. This project will not proceed until it has been determined that no permit will be necessary or until any permits have been obtained, if needed; however, a preliminary review has indicated that it is not expected that a permit will be necessary.

4. Radioactive materials/soil:

A 100 μCi ^{252}Cf source will be used to help calibrate the BWAS. Other radionuclides will also be used in the calibration of this equipment. These include, per year, <2 kilogram ^{239}Pu or ^{240}Pu , <1 gram ^{241}Am , and <600 grams ^{235}U . The radionuclides will be placed in enclosed tubes, which will then be placed in 4 foot by 4 foot by 8 foot double-encapsulated boxes filled with surrogate waste consisting of gloves, paper, and other nonhazardous materials. The radionuclides will be used throughout the calibration and testing, as will the surrogate wastes.

After measurements with the surrogate wastes are completed, real waste that has been previously packaged and measured (using similar NDA instruments) will be used to further calibrate and test the Boxed Waste Assay System.

The surrogate wastes will be disposed of as solid low-level radioactive waste. Between 2-3 crates, each size 4' x 4' x 8', will be disposed of. Solid low-level waste (LLW) is taken by Waste Management (EM-7) personnel to the LLW management burial area at TA-54. The waste management aspects of this project will be reviewed for compliance with the Resource Conservation and Recovery Act.

15. Radiation/toxic chemical exposures:

All work will be done so as to protect the health and safety of workers and the environment. Both engineering and administrative controls will be in place, as well as the use of personal protective equipment by workers. The principles of ALARA (as low as reasonably achievable) will be strictly followed. All facility SOPs, as well as Laboratory policies will be followed.

ENVIRONMENTAL CHECKLIST
DOE Albuquerque Operations Office
Testing/Verification for the Boxed Waste Assay System
DEC-93-0320, ACC NO. 4570

WHC-SD-W026-TC-002
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Block C: PERMITS

The intent of the Laboratory is to conduct the project/activity in accordance with all applicable statutory and regulatory requirements, permits, and DOE Orders. The project/activity has been reviewed under the Environment, Safety, and Health questionnaire screening process at the Laboratory. Permit modifications, notifications, reviews, and/or registrations may be required in the following areas before beginning operations.

**RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) RADIOACTIVE WASTE
REVIEW**

AIRBORNE RADIOACTIVE EMISSION - CONSTRUCTION/MODIFICATION APPROVAL

Additional regulatory issues may be identified as the project develops.

ENVIRONMENTAL CHECKLIST
DOE Albuquerque Operations Office
Testing/Verification for the Boxed Waste Assay System
DEC-93-0320, ACC NO. 4570

WHC-SD-W026-TC-002
REV 0

Block D. NCO CLASSIFICATION/RECOMMENDATION:

Signature: _____

Title: _____ Date: _____

Block E. EH OBJECTION/DETERMINATION: Yes ___ No ___

Signature: _____

Title: _____ Date: _____

ATTACHMENT C

Los Alamos Los Alamos National Laboratory
Los Alamos, New Mexico 87545**memorandum**

TO: Joseph Wachter, NMT-4, MS E513

DATE: September 21, 1993

THRU Jeff Carmichael, EM-8 *JP*

MAIL STOP/TELEPHONE: K490/7-1573

FROM John Pieniazek, EM-8 *JP*

SYMBOL EM-8:93-2523

SUBJECT **ES&H PROJECT QUESTIONNAIRE 93-0159**

I have reviewed ES&H Project Questionnaire 93-0159, "CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM," and have made the following determinations:

- No further Resource Conservation and Recovery Act (RCRA) action required. Hazardous or mixed waste, is not generated.
- Low-Level radioactive solid waste (LLW) will be generated.

Comments: Guidance for the management of LLW can be found in Administrative Requirement (AR) 10-2 in the Laboratory's *Environment, Safety and Health Manual*. If you have questions, I can be contacted at the above mail stop or telephone number.

JP:JC:ac

Cy: Ann Pendergrass, EM-8, MS K490
Circ. File
EM-8 File

ATTACHMENT D

Los Alamos
NATIONAL LABORATORY

ATTACHMENT D

memorandum

TO: Joseph Wachter, NMT-4, MS E513

DATE: September 29, 1993

FROM: Doug Stavert, EM-8 MS K490 *gs*

MAIL STOP/TELEPHONE: K490/5-0235

SYMBOL: EM-8:93-2661

SUBJECT: NESHAP 40 CFR PART 61 RADIOACTIVE AIR EMISSIONS REVIEW:
CONCEPTUAL DESIGN REPORT FOR HANFORD SYSTEM

ES&H Questionnaire Number: 93-0159
Lab Project I.D.: 93-NONE

EM-8 has reviewed the referenced project, and based on the information provided to us, we have determined your project does not require a radioactive air emissions pre-construction application under 40 CFR Part 61 (National Emissions Standards for Hazardous Air Pollutants - NESHAP).

According to the information you provided, the project involves performing a characterization of a neutron-based waste measurement system in the basement of TA-55. The system is a nondestructive assay system which will use passive-active neutron and gamma energy analysis techniques to assay waste boxes. The waste to be used to test the system will be both existing waste and mock waste created at TA-55. Waste will be created by filling clean crates with assorted debris (steel, plastic, etc.) and placing double-contained calibration sources within the crates. These crates of mock waste will have no radionuclide emissions. The existing waste to be used in the system testing is currently being stored at TA-55. These waste boxes will simply be relocated to the assay system area for measurement. The relocation of existing radionuclide sources is exempted from having to obtain preconstruction applications under Subpart A of 40 CFR Part 61.

Provided that the scope of this project does not change, the project will not require permitting under 40 CFR Part 61. Should it be necessary to change the scope of this project, please contact me so that we can re-evaluate the need for a pre-construction application. We appreciate your cooperation in our review process.

DS:do

Cy: L. Andrews, HS-DO/RAEM, MS E528
J. Dann, Radian Corp., MS K490
NEPA, EM-8, MS K490
NESHAP File
Circ. File

ATTACHMENT E

ATTACHMENT E

Los Alamos

NATIONAL LABORATORY

memorandum

Policy and Program Analysis

To/MS: Joe Wachter, NMT-4, MS E513

From/MS: Glenn Neely, HS-12, MS K483

Phone/FAX: 7-7717/7-9726

Symbol: HS-12:93-584

Date: August 25, 1993

SUBJECT: ES&H QUESTIONNAIRE NO. 93-0159, TA-55-BASEMENT CONCEPTUAL DESIGN REPORT (CDR) FOR HANFORD SYSTEM

As per our meeting on August 10, 1993, (E. Mullen, G. Neely, J. Wachter), the following items were discussed:

- The Boxed Waste Assay system measures 10'X12'X32' and will be located in the basement of PF-4.
- The counting system is being constructed by Pajarito Scientific Corporation in Los Alamos.
- Eight ¹³⁷Cs sources and eight ⁶⁰Cs sources, 10 mCi each are containing within the counting system and are utilized for transmission correction factors, i.e., thickness of various waste being assayed. (Packaging plus contents)
- Irradiation perimeters are as follows:
  - ✓ 10u Sec pulses
  - ✓ 50 Hertz
  - ✓ 10,000 pulses per assay
  - ✓ neutrons/sec = 1.0×10^6
  - ✓ 4.5 Ci of tritium in the DT generator

Considerations:

- A n+γ survey of the 10'X12'X32' Assay System is required to characterize radiation levels during operation. (Hand held instruments and planted TLDs ⁶Li+⁷Li)
- A PNR-4 neutron instrument or equivalent may not respond to the "pulsed" neutrons. An Albatross type (integrating) neutron instrument may be required.
- An SOP will be prepared for the Operation of the Assay system.
- As per user, there are no radioactive contamination problems associated with this limited term project.

GN:dr

Attachment

Cy: J. Dawson, (w/att.), HS-1, MS E503
J. Castro, (w/att.), HS-1, MS E503
R. Huchton, (w/att.), HS-1, MS 487
G. Schlapper, (w/att.), HS-12, MS K483

E. Mullen, (w/o att.), HS-12, MS K483
D. Heineman, (w/o att.), HS-3, MS K479
HS-12 File

ATTACHMENT F

Los Alamos

NATIONAL LABORATORY

memorandum

Health and Safety Division
Radioactive Air Emissions Management

To/MS: Joseph Whacter, NMT-4, E513
From/MS: Kevin Smale, HS-9, E528 *Kevin P. Smale*
Phone/FAX: 5-2169/FAX 5-8858
Symbol: HS-9:93-238
Date: August 9, 1993

RESPONSE TO QUESTIONNAIRE # 93-0159

The Radioactive Air Emissions Group, HS-9, has reviewed your questionnaire and has determined that no further action for HS-9 is required. Please call if I can be of further assistance.

xc: HS-9 File, MS E528
HS-9 Data Management Section, MS E528
HS-9 ES&H Files, MS E528
G. Barnes, HS-3, MS K479

ATTACHMENT G

Los Alamos Los Alamos National Laboratory
Los Alamos, New Mexico 87545**memorandum**

TO Joe Wachter, NMT-4, MS E513
THRU John Krueger, EM-7, MS J595
FROM Rosemary Glenn, EM-7
SUBJECT ES&H QUESTIONNAIRE # 93-0159

DATE August 10, 1993
MAIL STOP/TELEPHONE J595/5-6157
SYMBOL EM-7G-93-422

We have no comments regarding radioactive waste generation as a result of this project. We are, however, interested in your evaluation of the assay equipment, especially with regard to assay of low-level waste, and would appreciate being included on any distribution of information or for any demonstrations.

RG.lpc

Cy: M. G. Barnes, HS-3, MS K479
EM-7 Group Office, E517
EM-7 RMDC, MS J594
EM-7 File, MS J592

ATTACHMENT H

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Memorandum

Aug 6, 1993

ES13/5-1977

NMT-04-93-375

Patrick J. Josey, EM-DO, MS K572

William A. Sedacek, NMT-4

Joseph R. Wachter, NMT-4

MEMORANDUM OF CLOSURE

This memorandum is being sent to verify our discussions of Aug 6, 1993 concerning E&H Questionnaire 93-0159. During the discussion, waste minimization requirements for the project covered by the Questionnaire were reviewed and you indicated that all EM-DO waste minimization issues were resolved.

For record-keeping purposes for the project, NMT-4 is requesting your concurrence that all waste minimization issues are resolved for the Questionnaire by signing the memorandum below and returning it to us. Our FAX number is 865-8180.

We appreciate your prompt attention to this matter.

Patrick J. Josey

Distribution:
Author Copy
NMT-4 File Copy

ATTACHMENT I

Los Alamos

NATIONAL LABORATORY

memorandum

Health and Safety Division
HS-6 • Criticality Safety Group

To/MS: Joe Wachter, NMT-4, MS E513

Thru: T. P. McLaughlin, HS-6, MS F691

From/MS: Stuart G. Vessard, HS-6, MS F691

Phone/FAX: 5-2817/FAX 5-4970

Symbol: HS-6-93-175

Date: August 24, 1993

Subject: Criticality Safety Guidance for Testing and Evaluation of the Hanford Box Counting System (Reference HSE-Q-93-0159)

On August 10, 1993 I reviewed with you the proposed operation for the evaluation of a new box counting system. This system is designed for assaying large boxes of waste items, and is destined for installation at the Hanford Site. The system is formally termed the Boxed Waste Assay System (BWAS). The following is our understanding of the intended operations, and our initial thoughts regarding the potential criticality safety concerns for the proposed operations. Please let me know if the following comments are technically correct, and comprehensive.

- The proposed operation will be conducted in the PF-4 Basement, in the south half of the basement, against the south wall, just east of the tunnel connection for PF-41.
- At present there is no SOP, but one will be written and sent through the approval process before work commences.
- This project will be subject to the TA-55 START process.

The intended activities for the evaluation of the BWAS include:

- To count different size boxes (see Tables 3-1 and 3-2). These boxes will be:
  - LLW and TRU waste containers, and
  - Will be loaded with different materials to represent:
    - * Light density materials at 0.1 g/cm^3 , e.g., plastics,
    - * Moderate density materials at 0.2 g/cm^3 , e.g., wood and
    - * High density materials at 0.8 g/cm^3 , e.g. metals.
  - The weight of the boxes will typically range from 200 kg up to 1600 kg.

The quantities and types of fissile material include:

- The total quantity of fissile material to be counted at a time will vary from sub gram quantities up to 2000 grams of plutonium.
- The fissile material will be non-hydrogenous and in the form of sealed sources.
- These sources will be placed inside of steel pipes (typically on the order of 5 inches in diameter) that run perpendicular to the length of the box and are uniformly spaced over the volume of the box.

The BWAS is defined in the attached figures, but includes:

- A fully enclosed assaying chamber that contains:
  - ^3He counters and associated moderators for neutrons,

- NaI detectors for gamma and
- HPGe detectors for specific gamma measurements.
- A turntable and conveyor system for transporting the waste boxes into the assaying chamber.
  - The conveyor system is connected to an interlocking system. This interlock system monitors the "FLUX" of the incoming box. If the flux exceeds a prescribed set point, then the conveyor is stopped, and the door can not be closed.

Criticality Safety Concerns

The use of up to 2000 grams of Pu as a sealed source where the Pu is non-hydrogenous poses no undue criticality safety concerns for the proposed operation of calibrating the BWAS. This is based on:

- No single source of the fissile material will go critical even if thick water reflected. This is conservative because water has a higher density than the proposed waste matrices.
- Interaction between any two sources will be negligible unless they are placed side by side inside the same 5 inch diameter pipe. Placement of any number of sources, up to the proposed 2000 gram Pu limit, inside the same pipe does not pose any undue criticality safety concerns.
- The waste boxes cannot be made to appear optimally moderated, from a neutronic sense, based on the diameter of the pipes and the geometry of the sources, i.e., the sources will resemble point sources more than large thin foils.
- The average fissile density is well below a limiting critical concentration in water and the hydrogenous matrix is much less dense than water (0.1 - 0.2 g/cc), this provides much greater neutron leakage than the equivalent water-fissile system.
- The use of Uranium using a one for one equivalence between the ^{235}U isotope and plutonium would pose no undue criticality safety concerns.

One area that has not been addressed is the storage of the fissile material sources. Depending on the total quantity of fissionable material this could pose a potential criticality safety concern. One option, and this is only a suggestion, would be the assignment of a floor space near the BWAS and using a floor safe to store the sources when not in use. Let us know how you would like to store these sources, and we will work with you.

If you have any questions, corrections, additional information, or requests, then please get in touch with us.

SV: sv

HS-6-93-175

Cy:
Ray Wagner, NMT-4, MS E513
Dennis Brandt, NMT-4, MS E513
File

TABLE 3-1
TEST MATRIX TARGET VALUES

TARGET VALUES FOR WASTE DENSITY AND RADIONUCLIDE LOADING								
BOX TYPE	MATRIX AND DENSITY	WASTE		PLUTONIUM		¹³⁷ Cs uCi	⁶⁰ Co uCi	
		Wt	Cat	Act.	Wt			
B-25 90 ft ³ 2.5 m ³	Lab Waste 0.1 g/cm ³	560 lb	LLW-1	5 nCi/g	15 mg	50	50	
		250 Kg	LLW-3	15 nCi/g	46 mg	400	400	
	Moderate 0.2 g/cm ³	1100 lb	LLW-1	5 nCi/g	30 mg	50	50	
		500 Kg	LLW-3	15 nCi/g	91 mg	400	400	
	Heavy 0.8 g/cm ³	4500 lb	LLW-1	5 nCi/g	120 mg	50	50	
		2000 Kg	LLW-3	15 nCi/g	370 mg	400	400	
LLW-3+			15 nCi/g	370 mg	400	400		
SWB 72 ft ³ 2.0 m ³	Lab Waste 0.1 g/cm ³	450 lb 200 Kg	TRU	50 nCi/g	120 mg	50	50	
				150 nCi/g	370 mg	400	400	
				NA	1 g			
				NA	10 g			
				NA	50 g			
		Moderate 0.2 g/cm ³	900 lb 400 Kg	TRU	50 nCi/g	240 mg	50	50
					150 nCi/g	740	400	400
					NA	1 g		
	NA				10 g			
				NA	50 g			
		Heavy 0.8 g/cm ³	3600 lb 1600 Kg	TRU	50 nCi/g	980 mg	50	50
					150 nCi/g	3 g	400	400
					NA	50 g		
	NA				100 g			
	NA				200 g			
	NA				400 g			

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File: C:\WRAP1\FACILITY\LANL-250W

TABLE 3-2(cont)
TEST MATRIX TARGET VALUES

TARGET VALUES FOR WASTE DENSITY AND RADIONUCLIDE LOADING							
BOX TYPE	MATRIX AND DENSITY	WASTE		PLUTONIUM		¹³⁷ Cs	⁶⁰ Co
		Wt	Cat	ACL	Wt	uCi	uCi
LARGE BOX	Lab Waste 0.1 g/cm	1000 lb 450 Kg	LLW-1	5 nCi	27 mg	90	90
			LLW-3	15 nCi	82 mg	720	720
			LLW-3	50 nCi	270 mg		
			TRU	150 nCi	820 mg		
				NA	10 mg		
				NA	50 g		
				NA	100 g		
	Moderate 0.2 g/cm	2000 lb 900 Kg	LLW-1	5 nCi	36 mg	90	90
			LLW-3	15 nCi	160 mg	720	720
			LLW-3	50 nCi	540 mg		
			TRU	150 nCi	1.6 g		
				NA	10 g		
				NA	50 g		
				NA	100 g		
				NA	200 g		
	Heavy 0.8 g/cm	7900 lb 3600 Kg	LLW-1	5 nCi	220 mg	90	90
			LLW-3	15 nCi	660 mg	720	720
			LLW-3	50 nCi	2.2 g		
			TRU	150 nCi	6.6 g		
				NA	50 g		
				NA	100 g		
				NA	200 g		
				NA	400 g		
				NA	600 g		
				NA	1 Kg		
				NA	2 Ky		

INTERLOCK LOGIC DIAGRAM

STATEMENT OF WORK, TESTING OF THE BWAS AT LANL

INTRODUCTION

Westinghouse Hanford Company (WHC) has contracted with Pajarito Scientific Corporation (PSC) for the design and fabrication of a Boxed Waste Assay System (BWAS), intended for use in the Waste Receiving and Processing (WRAP) facility at Hanford. The procurement specification (WHC-S-033) requires that qualification and characterization testing be performed to verify that the BWAS meets or exceeds procurement specification requirements.

The attached scope of work identifies BWAS Test program activities which would be performed at, and by Los Alamos National Laboratories (LANL).

BACKGROUND

The BWAS is a nondestructive assay system which uses Passive-Active Neutron (PAN), and Gamma Energy Analysis (GEA) techniques to assay waste boxes up to 8' long, by 5' wide and 5' tall. The overall dimensions of the device are approximately 33 feet long, 10 feet wide, and 12 feet high, with a total system weight of 40,000 pounds. Attachment 1, drawing number H-2-89510 is the system interface drawing for WRAP, and shows the device being loaded with a box from the side by a forklift.

The BWAS Qualification and Characterization Test Program will be performed in two distinct phases. The first phase will be testing completed at PSC facilities, and will primarily focus on the performance of the GEA portion of the instrument. The second phase, to be conducted at LANL, will emphasize the neutron assay portion of the instrument. The schedule for the test program is included as Attachment 2.

ATTACHMENT J

Los Alamos

NATIONAL LABORATORY

memorandum

To/MS: Joseph Wachter, NMT-4, MS E513
From/MS: Sharon Aragon, HS-5, MS K403 *SA Aragon*
Phone/FAX: 7-2375/FAX 5-7384
Symbol: HS-5-93-1075
Date: August 26, 1993

Health and Safety Division

ES&H PROJECT QUESTIONNAIRE: 93-0159

As we have discussed, my main concerns about this project involve the conveyor belt portion of the neutron counter. The information you provided me was very helpful and satisfied my concerns. I consider the Industrial Safety portion of this questionnaire to be "closed". Please call me if you have any questions or concerns.

SA:sg

Cy: Fred Bolton, HS-5, MS K403
Gaye Barnes, HS-3, MS K479
HS-5/OS Reading File, MS K403

SKA93013.MSW